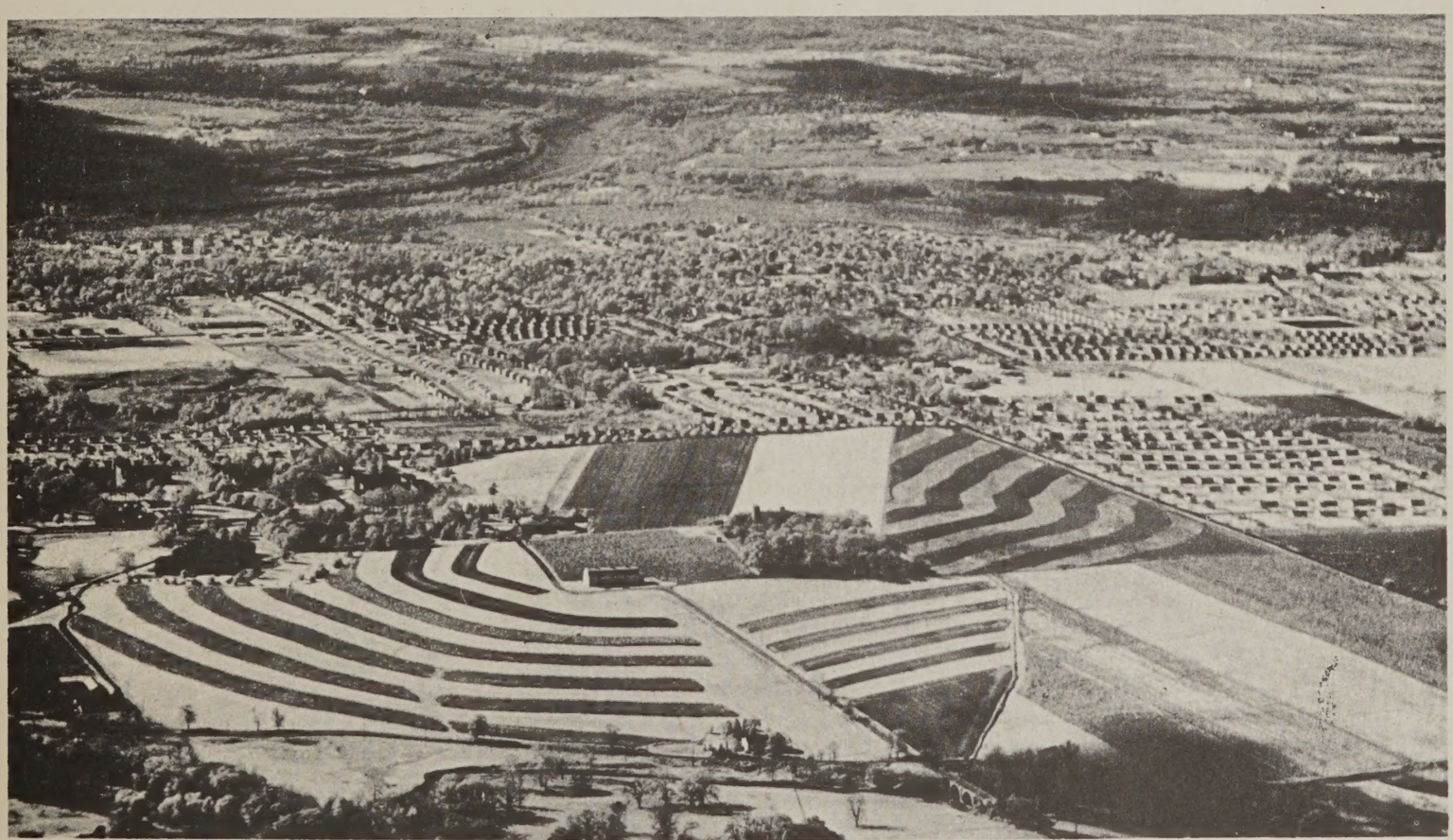
Condensed

SOIL SURVEY MONTGOMERY COUNTY

Pennsylvania



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
THE PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Agricultural Experiment Station
and
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
State Soil and Water Conservation Commission

Reprinted with permission by Montgomery County Conservation District. June 1986
2nd Reprint October 1989
3rd Reprint October 1993

Condensed
SOIL SURVEY
MONTGOMERY COUNTY
Pennsylvania

Soils and Community Developments

Residential, commercial, industrial, and institutional developments are growing rapidly in Montgomery County as the suburbs of Philadelphia and Norristown expand into rural areas. The rapidity with which developments have expanded in the past has led to many problems. These problems clearly show the need for careful planning and for a broad understanding of the physical and economic aspects involved when the use of the land is changed.

This soil survey will help in planning these developments and in solving problems that arise as use of the land changes. Planning officials and developers, as well as homeowners and others, can find useful information in the soil maps, in the text, and in the tables in this survey. The detailed soil maps in the back of the survey are useful because they show the location of each of the soils in the county. The colored general soil map that precedes the detailed soil maps shows the pattern of the major soils within the county. All of the soils are discussed in detail in the section "Descriptions of the Soils." Engineering characteristics of the soils are discussed in the section "Engineering Properties of the Soils."

In table 8 the limitations of the soils in the county for specified uses in community developments are rated as *slight*, *moderate*, or *severe*. Where the limitations for a specified use are rated moderate or severe, the chief limitation for the use specified is shown. A rating of severe does not imply that the soil cannot be used for the purpose indicated, but it does indicate that the soil is poorly suited to the purpose named.

In the column showing major limitations to use of the soils for residential developments, only homes three stories or less in height are considered. Buildings taller than three stories are not considered, because complicated problems could arise if these soils are used for foundations for larger buildings. In determining the degree of limitations for residential developments, disposal of effluent from septic tanks was not considered.

Figure 13.—**An area where argillite has been quarried for use on county roads. The quarry and the surrounding areas that have been disturbed are mapped as Made land, shale and sandstone materials.**

TABLE 8.—*Major soil properties and estimated degree of limi-*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
AbA	Abbottstown silt loam, 0 to 3 percent slopes.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
AbB2	Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Moderate; slope; depth to bedrock.	Severe; slow permeability; seasonal high water table.
BlB2	Beltsville silt loam, 2 to 6 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
Bm	Bermudian silt loam	12	Severe; flooding	Severe; flooding	Severe; moderately rapid permeability; flooding.	Severe; flooding
BnA	Birdsboro silt loam, 0 to 3 percent slopes.	1	Slight	Slight	Moderate; moderate permeability.	Slight

See footnotes at end of table.

In the column showing properties that influence the suitability of the soils for light industrial, commercial, and institutional developments, stores, shopping centers, community schools, churches, and light industrial buildings three stories or less in height are considered. In this column uses for heavy industrial establishments are not considered.

In the following pages, the soils of the county are placed in 13 community development groups on the basis of soil features that affect their use for building sites and for other community developments. These features include depth of the soil, degree of slope, permeability, estimated percolation rate, content of stones, and susceptibility to erosion and flooding. The use of the soils for community developments is discussed, especially the use of the soils as a disposal field for septic tanks and as a foundation for a building three stories or less in height. Limitations for other specified uses are given in table 8. The names of soil series represented are mentioned in the description of each community development group, but generally not all the soils of a given series appear in the unit. The development group to which each soil belongs can be found in table 8. Also, to find the names of the soils in any given community development group, the reader can refer to the "Guide to Mapping Units, Capability Units, and Community Development Groups" at the back of this soil survey.

COMMUNITY DEVELOPMENT GROUP 1

In this group are areas of Made land and of deep, well-drained soils of the Birdsboro, Chester, Duffield, Edgemont, Howell, Lansdale, Murrill, and Neshaminy series. Most of these soils are moderately eroded. Their slopes are mainly between 0 to 8 percent.

These soils are generally moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Edgemont soil, however, has moderately rapid permeability, and the Neshaminy soils have moderately slow permeability. Depth to bedrock is generally more than 4 feet and exceeds 15 feet in many places. Bedrock is exposed at the surface however, in some areas of Made land. The seasonal high water table is below a depth of 3 feet. A large amount of moisture is held available for plants.

The soils of this group have few limitations for use as sites for residential, light industrial, commercial, and institutional developments. The slope gradient, depth to bedrock, depth to a seasonal high water table, and permeability are all favorable. Grading can be done without difficulty, but large stones and boulders are a problem on the very stony Neshaminy soil.

In some places the limestone bedrock underlying Made land, limestone materials, and the Duffield and Murrill soils contains solution channels. These are openings or underground caverns created where the limestone bedrock dissolved and left a channel or tunnel. An investigation of the underlying rock should be made before construction is begun on roads and large or heavy structures in areas of Duffield and Murrill soils and in areas of Made land, limestone materials.

The Chester and Duffield soils and Made land are unstable, easily eroded, and subject to frost action and gullying if they are disturbed. Excavated areas should be protected with grass or a mulch to prevent serious erosion.

tation that influence use of the soils for community developments

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; wetness	Moderate; wetness	Severe; wetness	Moderate; wetness	Severe; wetness	Severe; wetness.
Moderate; wetness	Moderate; wetness; slope.	Severe; wetness	Moderate; wetness	Severe; wetness	Severe; wetness.
Moderate; wetness	Moderate; wetness; slope.	Severe; wetness; slope.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; occasional flooding.	Severe; flooding	Moderate; flooding	Moderate; flooding	Severe; flooding	Severe; flooding.
Slight	Slight	Slight	Slight	Slight	Slight.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
BnB2	Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; moderate permeability; slope.	Slight
Bo	Bouldery alluvial land	12	Severe; flooding; boulders.	Severe; flooding	Severe; flooding	Severe; flooding; high water table.
Bp	Bowmansville silt loam	12	Severe; flooding and high water table.	Severe; flooding; high water table.	Severe; flooding	Severe; flooding; high water table.
BrA	Bowmansville silt loam, local alluvium, 0 to 3 percent slopes.	12	Severe; high water table and ponding.	Severe; high water table and ponding.	Severe; local flooding.	Severe; high water table and ponding.
BrB	Bowmansville silt loam, local alluvium, 3 to 8 percent slopes.	12	Severe; high water table.	Severe; high water table.	Moderate; slope	Severe; high water table.
BsB2	Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to to bedrock.	Severe; variable depth to bedrock.
BsC2	Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; variable depth to bedrock.
BsD2	Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; steep; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.
BtC	Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes.	4	Moderate; slope; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
BtD	Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes.	5	Moderate; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; steep; shallow to bedrock.
BvD	Brecknock very stony silt loam, 8 to 25 percent slopes.	5	Moderate; shallow to bedrock; stony.	Moderate to severe; slope.	Severe; slope	Severe; shallow to bedrock; stony; slope.
CfA	Chalfont silt loam, 0 to 3 percent slopes.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
CfB2	Chalfont silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; seasonal high water table.	Severe; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
CgA2	Chester silt loam, 0 to 3 percent slopes, moderately eroded.	1	Slight	Moderate; fair to poor stability.	Severe; permeable	Slight
CgB2	Chester silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Moderate; fair to poor stability.	Severe; permeable	Slight

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Severe; stones and boulders; wetness.	Severe; wetness; boulders.	Severe; boulders; flooding.	Severe; boulders; flooding.	Severe; flooding	Severe; flooding.
Severe; high water table.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.	Severe; wetness; flooding.
Severe; wetness	Severe; wetness	Severe; wetness	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; wetness	Severe; wetness	Severe; wetness	Severe; high water table.	Severe; high water table.
Slight to moderate; variable depth to bedrock.	Moderate; shallow to bedrock.	Severe; channery; shallow to bedrock; slope.	Slight	Moderate; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; channery.	Severe; slope; shallow to bedrock.	Severe; slope	Severe; steep	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; erosion.	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.
Moderate to severe; stony; slope.	Severe; slope; shallow to bedrock; stony.	Severe; slope	Moderate to severe; steep and stony.	Severe; steep; shallow to bedrock and stony.	Severe; steep; shallow to bedrock.
Moderate; wetness	Moderate; seasonal high water table.	Severe; seasonal high water table.	Moderate; seasonal high water table.	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; wetness	Moderate; wetness	Severe; wetness	Moderate; wetness.	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Slight	Slight	Slight	Slight	Slight.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
Ch	Codorus silt loam	12	Severe; flooding	Severe; flooding	Severe; flooding; moderate permeability.	Severe; flooding; high water table.
CrA	Croton silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table.	Slight	Severe; slow permeability and high water table.
CrB2	Croton silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; high water table.	Severe; high water table.	Moderate; slope	Severe; slow permeability and high water table.
CsB	Croton very stony silt loam, 0 to 8 percent slopes.	11	Severe; high water table; stones.	Severe; high water table and poor stability.	Moderate; slope	Severe; slow permeability; stones.
DsA	Doylestown silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table; poor stability.	Slight	Severe; slow permeability; high water table.
DsB2	Doylestown silt loam, 3 to 8 percent slopes, moderately eroded.	11	Severe; high water table.	Severe; high water table; poor stability.	Moderate; slope	Severe; slow permeability; high water table.
DuB2	Duffield silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight; solution channels.	Moderate; permeable; possible pollution through solution channels.	Slight; possible pollution through solution channels.
DuC2	Duffield silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope; erodible.	Moderate; slope	Severe; permeable; slope.	Moderate; solution channels; slope; possible pollution of ground water.
DuC3	Duffield silt loam, 8 to 15 percent slopes, severely eroded.	2	Moderate; slope; erodible.	Moderate; slope	Severe; slope	Moderate; slope; possible pollution of ground water.
EcB2	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.	1	Moderate; limited depth to bedrock.	Moderate; limited depth to bedrock.	Severe; moderately rapid permeability.	Moderate; limited depth to bedrock.
EcC2	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; slope; limited depth to bedrock.
EcD2	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
EsD	Edgemont very stony loam, 8 to 25 percent slopes.	5	Moderate to severe; stones; slope.	Severe; slope	Severe; slope	Severe; slope
GnB2	Glenelg silt loam, 3 to 8 percent slopes, moderately eroded.	3	Slight	Slight	Severe; moderately rapid permeability.	Moderate to severe; variable depth to bedrock.
GnC2	Glenelg silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope	Moderate; slope	Severe; slope	Moderate to severe; variable depth to bedrock.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight; seasonal wetness and flooding.	Severe; flooding	Moderate; wetness	Moderate; flooding.	Severe; flooding	Severe; flooding.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness; stones.	Severe; high water table.	Severe; stones; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe: high water table.	Severe; high water table.
Severe; wetness	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.	Severe; high water table.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.
Severe; severe erosion.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Severe; erosion.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; variable depth to bedrock.	Moderate; limited depth to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; variable depth to bedrock.	Moderate; limited depth to bedrock.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Severe; slope; stones.	Severe; slope	Severe; slope	Severe; slope	Severe; slope; stones.	Severe; slope.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight to moderate; variable depth to bedrock.	Slight to moderate; variable depth to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
GnD2	Glenelg silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
GsA	Glenville silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
GsB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
Ha	Hatboro silt loam	12	Severe; flooding and high water table.	Severe; flooding and high water table.	Severe; flooding and inflow.	Severe; high water table; flooding.
HwB2	Howell silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; moderate permeability to a depth of 4 feet.	Moderate; moderate permeability.
KlB2	Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.	Severe; shallow to bedrock.
KsB3	Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; slope; shallow to bedrock (rippable).	Severe; shallow to bedrock.	Severe; shallow to bedrock.
KsC3	Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded.	7	Moderate; shallow to bedrock (rippable).	Moderate; slope	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.
KsE3	Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded.	8	Moderate; shallow to bedrock (rippable).	Severe; slope	Severe; slope	Severe; slope
LaB3	Lansdale loam, thin, 3 to 8 percent slopes, severely eroded.	3	Slight	Slight	Severe; moderately rapid permeability in substratum.	Moderate; variable depth to bedrock.
LaC3	Lansdale loam, thin, 8 to 15 percent slopes, severely eroded.	7	Moderate; slope; shallow to bedrock.	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
LaE3	Lansdale loam, thin, 15 to 35 percent slopes, severely eroded.	5	Moderate to severe; slope; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope
LdA2	Lansdale silt loam, 0 to 3 percent slopes, moderately eroded.	1	Slight	Slight	Severe; moderate permeability.	Slight
LdB2	Lansdale silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Severe; moderately rapid permeability.	Slight
LdC2	Lansdale silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; slope

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Moderate; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; slope; seasonal high water table.	Slight	Moderate; seasonal high water table.	Severe; seasonal high water table.
Severe; wetness; flooding.	Severe; flooding; high water table.	Severe; flooding; high water table.	Severe; flooding; high water table.	Severe; wetness; flooding.	Severe; wetness; flooding.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; shallow to bedrock.	Moderate; slope; shallow to bedrock.	Severe; slope; wetness; shallow to bedrock.	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.
Moderate; slope; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock; erosion.
Severe; shallow to bedrock.	Moderate for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; erosion	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; variable depth to bedrock.	Moderate; variable depth to bedrock; eroded.
Severe; erosion	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope; droughty.	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Slight	Slight	Slight	Slight	Slight	Slight.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Moderate; slope	Moderate for roads; slope; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree of			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
LeA	Lawrenceville silt loam, 0 to 3 percent slopes.	9	Moderate; erodible; unstable; seasonal high water table.	Moderate; unstable; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table; fragipan.
LeB2	Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; erodible; unstable; seasonal high water table.	Moderate; slope; unstable; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
LgC3	Legore clay loam, 8 to 15 percent slopes, severely eroded.	7	Severe; shallow to bedrock.	Severe; slope	Severe; slope	Severe; variable depth to bedrock.
LgD3	Legore clay loam, 15 to 30 percent slopes, severely eroded.	8	Severe; shallow to bedrock.	Severe; slope	Severe; slope	Severe; slope
LhA2	Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded.	9	Moderate; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhB2	Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhB3	Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded.	9	Severe; shallow to bedrock; channery; seasonal high water table.	Severe; shallow to bedrock; wetness; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhC2	Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LhC3	Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded.	10	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
LsB	Lehigh very stony silt loam, 0 to 8 percent slopes.	9	Moderate; shallow to bedrock; seasonal high water table; stony.	Moderate; stony; shallow to bedrock.	Severe; shallow to bedrock; stony.	Severe; slow permeability; seasonal high water table.
LsD	Lehigh very stony silt loam, 8 to 25 percent slopes.	10	Moderate; slope; shallow to bedrock; stony.	Moderate to severe; slope.	Severe; slope; shallow to bedrock.	Severe; slow permeability; seasonal high water table.
Ma	Made land, diabase, gabbro materials.	3	Moderate	Moderate; stones; high content of clay.	Severe; shallow to bedrock; stones.	Severe; slow permeability.
Mb	Made land, land fill and sediment basins.	3	Severe; unstable	Severe; unstable	Severe; variable; permeable material.	Severe; variable; unstable material.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight; highly erodible.	Moderate; seasonal high water table.	Moderate; wetness; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight; erodible	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Severe; severe erosion.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; shallow to bedrock.	Moderate; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; shallow to bedrock.	Moderate; shallow to bedrock; slope; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; channery; shallow to bedrock.	Moderate; shallow to bedrock; slope; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; channery; shallow to bedrock.	Moderate for roads; severe for parking lots; shallow to bedrock; slope; seasonal high water table.	Severe; slope	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; channery; shallow to bedrock.	Severe; slope; wetness; shallow to bedrock.	Severe; slope; shallow to bedrock.	Moderate; wetness; slope.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; wetness; stony.	Moderate; slope; shallow to bedrock; wetness.	Severe; shallow to bedrock; wetness.	Slight to moderate; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; slope	Moderate to severe for roads; severe for parking lots; slope; shallow to bedrock.	Severe; slope	Moderate to severe; slope; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; stones and channers; high content of clay.	Slight; hard stones and bedrock near the surface.	Moderate; wetness; high content of clay.	Slight; high content of clay.	Severe; shallow to bedrock; wetness.	Severe; shallow to bedrock; wetness.
Moderate; variable	Severe; variable; unstable material.	Severe; variable; unstable material.	Moderate; variable material and conditions.	Severe; variable conditions.	Severe; variable conditions.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
Mc	Made land, limestone materials.	1	Moderate; variable depth to bedrock.	Moderate; solution channels in bedrock.	Severe; variable depth to bedrock.	Severe; possible pollution of ground water.
MdB	Made land, schist and gneiss materials, sloping.	1	Slight; variable depth to bedrock.	Slight; variable depth to bedrock.	Severe; rapid permeability.	Moderate; variable depth to bedrock.
MdD	Made land, schist and gneiss materials, strongly sloping.	2	Moderate; slope; erodible material; variable depth to bedrock.	Severe; slope	Severe; slope	Severe; slope; variable depth to bedrock.
MeB	Made land, shale and sandstone materials, sloping.	9	Moderate; variable conditions; possible seasonal high water table.	Moderate; variable conditions; possible seasonal high water table.	Severe; variable conditions; possible seasonal high water table.	Severe; shallow to bedrock; slow permeability; possible seasonal high water table.
MeD	Made land, shale and sandstone materials, strongly sloping.	10	Severe; slope; variable soil conditions; possible seasonal high water table.	Severe; slope	Severe; slope	Severe; shallow to bedrock; variable permeability.
MhB2	Manor channery silt loam, 3 to 8 percent slopes, moderately eroded.	3	Slight; shallow to bedrock in places.	Moderate; unstable; slope.	Severe; moderately rapid permeability.	Slight to moderate; variable depth to bedrock; possible pollution hazard.
MhC2	Manor channery silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope	Moderate to severe; poor stability; slope.	Severe; slope	Moderate to severe; slope; possible pollution hazard.
MhE2	Manor channery silt loam, 15 to 35 percent slopes, moderately eroded.	5	Moderate to severe; slope.	Severe; slope	Severe; slope	Severe: slope; shallow to bedrock.
MnB	Manor very stony silt loam, 0 to 8 percent slopes.	3	Moderate; shallow to bedrock in places.	Moderate; unstable; stones.	Severe; rapid permeability.	Severe; shallow to bedrock in places.
MnD	Manor very stony silt loam, 8 to 25 percent slopes.	5	Severe; stones; slope.	Moderate to severe; slope.	Severe; slope	Severe; slope; shallow to bedrock.
MoA	Mount Lucas silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
MoB2	Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; slope; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.
MoC2	Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; fair to poor stability.	Moderate; slope	Severe; slope	Severe; moderately slow permeability; seasonal high water table.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Slight	Moderate; caverns in bedrock.	Moderate; variable depth to bedrock.	Slight	Severe; variable conditions.	Severe; variable conditions.
Slight	Moderate; variable depth to bedrock.	Slight; variable depth to bedrock.	Slight	Moderate; variable depth to bedrock.	Moderate; variable depth to bedrock.
Moderate; channery; slope.	Moderate to severe; slope; variable depth to bedrock.	Severe; slope; variable conditions.	Moderate; slope; erodible materials.	Severe; slope; variable conditions.	Severe; slope; variable conditions.
Moderate; variable soil conditions.	Moderate; variable depth to bedrock.	Severe; variable conditions.	Moderate; variable conditions.	Severe; variable conditions; possible seasonal water table.	Severe; variable conditions; possible seasonal high water table.
Moderate; shaly; channery.	Moderate to severe; slope; variable depth to bedrock.	Severe; slope	Moderate; variable soil conditions.	Severe; variable	Severe; slope.
Moderate; shallow to bedrock; droughty.	Slight for roads; moderate for parking lots; slope.	Moderate; channery; slope.	Slight	Slight	Slight.
Moderate; shallow to bedrock; droughty.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock in places.	Moderate; shallow to bedrock in places.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; stones	Slight for roads; moderate for parking lots; slope; shallow to bedrock in places.	Severe; stones; shallow to bedrock.	Moderate; stones	Severe; stones; shallow to bedrock.	Severe; stones; shallow to bedrock.
Severe; slope; stones	Moderate to severe for roads; severe for parking lots; slope.	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock in places.	Severe; slope; shallow to bedrock in places.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe: seasonal high water table.
Slight	Moderate; slope; seasonal high water table.	Moderage; wetness; slope.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Moderate; slope	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope	Severe; seasonal high water table.	Severe; seasonal high water table.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
MuB	Mount Lucas very stony silt loam, 0 to 8 percent slopes.	9	Moderate; stones; fair to poor stability; seasonal high water table.	Moderate; seasonal high water table.	Slight to moderate; slope.	Severe; moderately slow permeability; seasonal high water table.
MuD	Mount Lucas very stony silt loam, 8 to 25 percent slopes.	10	Moderate; slope; stones; seasonal high water table.	Moderate to severe; slope.	Severe; slope	Severe; moderately slow permeability; slope; seasonal high water table.
MvB2	Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded.	1	Slight	Moderate; solution channels in bedrock; slope.	Moderate; permeable; possible pollution of ground water through solution channels.	Slight; possible pollution of ground water through solution channels.
NeB	Neshaminy extremely stony silt loam, 0 to 8 percent slopes.	8	Severe; stones	Severe; stones	Moderate to severe; slope; stones.	Severe; stones
NhB2	Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded.	1	Slight	Slight	Moderate; slope	Moderate; moderate to moderately slow permeability.
NhC2	Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded.	2	Moderate; slope	Moderate; slope	Severe; slope	Moderate; moderate to moderately slow permeability.
NhD2	Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded.	5	Moderate; slope	Severe; slope	Severe; slope	Severe; slope
NsB	Neshaminy very stony silt loam, 0 to 8 percent slopes.	1	Moderate; stones	Moderate; stones; fair to poor stability.	Moderate; stones	Slight to moderate; slope.
NsD	Neshaminy very stony silt loam, 8 to 25 percent slopes.	5	Moderate; slope; stones.	Moderate to severe; slope.	Moderate; slope	Moderate to severe; slope.
PaB2	Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PaB3	Penn shaly silt loam, neutral substratum; 3 to 8 percent slopes, severely eroded.	6	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PaC3	Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded.	7	Severe; shallow to bedrock.	Severe; shallow to bedrock.	Severe; slope; shallow to bedrock.	Severe; shallow to bedrock.
PeA2	Penn silt loam, 0 to 3 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Moderate to severe; variable depth to bedrock.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; stones; wetness.	Moderate; seasonal high water table.	Moderate; stones; seasonal high water table.	Slight; stones	Severe; seasonal high water table; stones.	Severe; seasonal high water table.
Moderate to severe; stones; slope.	Moderate to severe for roads; severe for parking lots; steepness; stones; seasonal high water table.	Severe; slope	Moderate to severe; slopes; stones.	Severe; steep; seasonal high water table.	Severe; steep; seasonal high water table.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Slight	Slight.
Severe; stones	Moderate for roads; moderate to severe for parking lots; slope; stones.	Severe; stones	Moderate; stones	Severe; stones	Severe; stones.
Slight	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; moderately slow permeability.	Moderate; variable depth to hard bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; slope	Moderate; slope.
Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope	Severe; slope.
Moderate; stones	Slight for roads; moderate for parking lots; slope.	Moderate; slope	Slight	Moderate; slope; stones.	Severe; stones.
Moderate to severe; slope.	Moderate to severe for roads; severe for parking lots; slope; stones.	Severe; slope	Moderate to severe; slope.	Moderate to severe; slope; stones.	Severe; slope; stones.
Moderate; shaly; shallow to bedrock.	Slight for roads; moderate for parking lots; shallow to bedrock.	Severe; shallow to shale.	Slight	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; shallow to bedrock; shaly; severe erosion.	Moderate; shallow to bedrock.	Severe; shallow to shale.	Slight	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Severe; shallow to bedrock; shaly; severe erosion.	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.	Moderate; slope	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; droughty	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Slight	Moderate; shallow to bedrock.	Severe; shallow to bedrock.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
PeB2	Penn silt loam, 3 to 8 percent slopes, moderately eroded.	3	Moderate; shallow to bedrock.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
PeB3	Penn silt loam, 3 to 8 percent slopes, severely eroded.	6	Moderate; shallow to bedrock (rippable).	Moderate; shallow to bedrock.	Severe; shallow to bedrock; slope.	Severe; shallow to bedrock.
PeC2	Penn silt loam, 8 to 15 percent slopes, moderately eroded.	4	Moderate; slope; shallow to shale (rippable).	Moderate; slope	Severe; slope	Severe; shallow to bedrock.
PeC3	Penn silt loam, 8 to 15 percent slopes, severely eroded.	7	Moderate; slope; shallow to shale (rippable).	Severe; shallow to bedrock.	Severe; slope	Severe; shallow to bedrock.
PfD	Penn very stony silt loam, 8 to 25 percent slopes.	5	Moderate; slope; shallow to bedrock.	Moderate to severe; slope.	Severe; slope	Severe; shallow to bedrock; stones.
PkD3	Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded. (both soils have the same rating.)	5	Moderate; slope; shallow to bedrock (rippable).	Severe; slope	Severe; slope	Severe; shallow to bedrock; slope.
PlB2	Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded. [3]	3				
PlB3	Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded. [3]	6				
PlC2	Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded. [3]	4				
PlC3	Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded. [3]	7				
PlD3	Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded. [3]	5				
RaA	Raritan silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; slow permeability; seasonal high water table.
RaB2	Raritan silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table	Moderate; seasonal high water table.	Moderate; slope	Severe; slow permeability; seasonal high water table.
ReA	Readington silt loam, 0 to 3 percent slopes.	9	Moderate; seasonal high table water.	Moderate; seasonal high water table.	Slight	Severe; moderately slow permeability; seasonal high water table.
ReB2	Readington silt loam, 3 to 8 percent slopes, moderately eroded.	9	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Moderate; slope	Severe; moderately slow permeability; seasonal high water table.

See footnotes at end of table.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; shallow to bedrock.	Moderate; slope; shallow to bedrock.	Severe; shallow to bedrock.	Slight	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; shallow to bedrock; severe erosion.	Moderate; shallow to bedrock; slope.	Severe; shallow to bedrock; slope.	Moderate; shallow to bedrock.	Severe; shallow to bedrock.	Severe; shallow to bedrock.
Moderate; slope	Moderate for roads; severe for parking lots; slope.	Severe; slope; shallow to bedrock.	Moderate; slope	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; shallow to shale.	Moderate for roads; severe for parking lots; slope.	Severe; slope	Moderate; slope	Moderate; shallow to bedrock (rippable).	Severe; shallow to bedrock.
Severe; slope; stones.	Moderate to severe for roads; severe for parking lots; slope.	Severe; slope	Moderate to severe; stony slopes.	Moderate to severe; slope; shallow to bedrock.	Severe; steep; slope; shallow to bedrock.
Severe; shallow to bedrock; slope.	Severe; slope	Severe; slope	Severe; slope	Severe; slope; shallow to bedrock.	Severe; slope; shallow to bedrock.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; slope; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.
Slight	Moderate; seasonal high water table.	Moderate; seasonal high water table.	Slight	Severe; seasonal high water table.	Severe; seasonal high water table.

TABLE 8.—*Major soil properties and estimated degree of limitation*

Map symbol	Soil	Community development group	Estimated degree			
			Residential developments of three stories or less (disposal of septic tank effluent not considered) [1]	Light industrial, commercial, and institutional developments of three stories or less	Sewage lagoons	On-site disposal of effluent from septic tanks
ReC2	Readington silt loam, 8 to 15 percent slopes, moderately eroded.	10	Moderate; slope; seasonal high water table.	Moderate; slope; seasonal high water table.	Severe; slope	Severe; moderately slow permeability; seasonal high water table.
RsA2	Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded.	9	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock.	Severe; slow permeability; shallow to bedrock.
RsB2	Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded.	9	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; slope.	Severe; slow permeability; shallow to bedrock; seasonal high water table.
RsB3	Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded.	9	Severe; seasonal high water table; shallow to bedrock.	Severe; seasonal high water table; shallow to bedrock.	Severe; shallow to shale.	Severe; shallow; slow permeability; seasonal high water table.
RsC3	Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded.	10	Severe; slope; shallow to bedrock; seasonal high water table.	Severe; slope; seasonal high water table.	Severe; slope; shallow to bedrock.	Severe; shallow to bedrock; slow permeability; seasonal high water table.
Rt	Rowland silt loam	12	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; high water table; flooding.
Ru	Rowland silt loam, coal overwash.	12	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; high water table.
RwA	Rowland silt loam, local alluvium, 0 to 3 percent slopes.	12	Moderate; occasional overflow; seasonal high water table.	Moderate; occasional overflow; seasonal high water table.	Moderate; occasional overflow; moderate permeability.	Severe; high water table.
RwB	Rowland silt loam, local alluvium, 3 to 8 percent slopes.	12	Moderate; occasional overflow; seasonal high water table.	Moderate; wetness; overflow.	Moderate; occasional overflow; moderate permeability.	Severe; high water table.
StE	Stony land, steep	13	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony
WaA	Watchung silt loam, 0 to 3 percent slopes.	11	Severe; high water table.	Severe; high water table.	Slight	Severe; very slow permeability; high water table.
WaB	Watchung silt loam, 3 to 8 percent slopes.	11	Severe; high water table.	Severe; high water table.	Moderate	Severe; very slow permeability; high water table.
Wc	Watchung very stony silt loam.	11	Severe; high water table; stones.	Severe; high water table; stones.	Moderate; inflow	Severe; very slow permeability; high water table.

[1] For residential developments, a rating of *moderate* is given for slopes of 8 to 25 percent.
[2] For roads in subdivisions, a rating of *severe* is given for slopes greater than 8 percent.

that influence use of the soils for community developments—Continued

of limitation for—

Landscaping and lawns at homesites	Roads and parking lots for subdivisions [2]	Intensively used athletic fields	Extensively used play areas	Sanitary land fill where trench method is used	Cemeteries
Moderate; slope	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope; wetness.	Severe; seasonal high water table.	Severe; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate seasonal; high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; seasonal high water table.	Moderate; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.	Moderate; wetness; shallow to bedrock.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Severe; shallow to bedrock; shaly.	Moderate for roads; severe for parking lots; slope; seasonal high water table.	Severe; slope	Moderate; slope; wetness.	Severe; shallow to bedrock; seasonal high water table.	Severe; shallow to bedrock; seasonal high water table.
Moderate; flooding; seasonal high water table.	Severe; flooding	Moderate; flooding; seasonal high water table.	Moderate; flooding.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.
Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.	Severe; flooding	Severe; flooding; seasonal high water table.	Severe; flooding; seasonal high water table.
Moderate; wetness	Moderate; seasonal high water table; overflow.	Moderate; wetness; overflow.	Moderate; wetness.	Severe; seasonal high water table; overflow.	Severe; seasonal high water table; overflow.
Moderate; wetness	Moderate; seasonal high water table; overflow.	Moderate; seasonal high water table; slope.	Moderate; wetness.	Severe; seasonal high water table; overflow.	Severe; seasonal high water table; overflow.
Severe; slope; stony	Severe; slope; stony	Severe; slope; stony	Severe; slope; stony.	Severe; slope; stony	Severe; slope; stony.
Severe; wetness; high content of clay.	Severe; high water table.	Severe; high water table.	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness; high content of clay.	Severe; wetness	Severe; high water table.	Severe; wetness	Severe; high water table.	Severe; high water table.
Severe; wetness; stony.	Severe; high water table; stony.	Severe; high water table; stony.	Severe; wetness; stony.	Severe; high water table; stony.	Severe; high water table; stony.

[3] For properties and limitations, see the Penn and Lansdale soils that have similar slopes and a similar degree of erosion. Where ratings of the two components of these complexes differ, the more restrictive limitation ordinarily will show the hazards of the area.

All of these soils, except the Duffield and Murrill soils and Made land, limestone materials, have only slight limitations as foundations for residences and similar buildings. Deep excavations, however, in the Neshaminy, Duffield, and Murrill soils, and in areas of Made land, may require that hard diabase or limestone bedrock be removed (fig. 14).

Figure 14.—**Exposed limestone ledges in an area of Made land, limestone materials, where the soil material has been removed when the area was graded for an industrial development.**

Most of these soils have slight limitations as disposal fields for the effluent from septic tanks. Moderate or moderately slow permeability in the Neshaminy and Howell soils, and in Made land, generally restricts use as a disposal field unless the results of percolation tests at the specific site are favorable. Solution channels in the bedrock underlying Made land, limestone materials, and the Duffield soil may cause contamination of the ground water because of poor filtration of the effluent. Most of these soils have slight limitations for use for sanitary land fill.

The soils of this group have few limitations if used for farming, home gardens, nurseries, lawns, or landscape plantings. Made land is fair for lawns and landscaping but needs close investigation where other uses are planned. Most of these soils are a source of fair to good topsoil, but the quantity is limited. After these soils have been disturbed, plants will grow on them, but every effort should be made to replace the original topsoil. Doing this encourages rapid regrowth of vegetation and thus reduces loss of soil material through sheet erosion and gullying. The Edgemont and Lansdale soils are likely to contain many fragments of sandstone and to be droughty if much of the soil material is removed by grading or other construction work.

COMMUNITY DEVELOPMENT GROUP 2

This group consists of Made land and of well-drained, moderately or severely eroded soils of the Duffield, Edgemont, Lansdale, and Neshaminy series. The slopes range from 8 to 15 percent.

The permeability of these soils ranges from moderately slow to moderately rapid, and the percolation rate ranges from 0.63 inch to 2 inches per hour. Depth to hard bedrock is generally more than 3 feet, and it exceeds 10 feet in some places. The seasonal high water table is below a depth of 3 feet. The supply of moisture held available for plants is moderate to large.

The strong slopes are a limitation to use of these soils for residential developments. They are a moderate limitation to use of the soils for light industrial, commercial, or institutional developments. Depth to bedrock, depth to a seasonal high water table, and permeability are favorable for residential developments, and grading can be done without serious difficulty. The Duffield and Neshaminy soils are unstable, however, and are subject to slippage and to sheet and gully erosion if they are disturbed. They are especially likely to slip or erode where the slopes are the strongest.

These soils are generally good for foundations. Also, little or no quarrying of the bedrock is required in most places where an excavation is made for a residence. On the steeper slopes, however, soil creep may be a problem, and bedrock or hard stones are likely to be encountered where a deep cut is made. Because of the possibility that the Duffield soils are underlain by cavernous limestone, those soils should not be used for a heavy structure unless a geologic investigation has been made of the bedrock at the site.

Most of these soils absorb a normal load of effluent from a septic tank used for a residence. The Neshaminy soil and Made land may have limitations if used for that purpose, however, unless the results of percolation tests at the specific site are favorable. Intensive use of the Duffield soils as a disposal field for the effluent from septic tanks may cause contamination of the ground water because of the solution channels in the bedrock and inadequate soil filtration.

The soils of this group are generally well suited to farming, home gardens, nurseries, lawns, and landscape plantings. Runoff needs to be controlled, however, or serious erosion will result. Lawns, trees, and shrubs grow well in areas where the soils have been disturbed, but every effort should be made to replace the original topsoil. Where the topsoil has been restored, vegetation becomes reestablished more quickly and losses from erosion are reduced. The Edgemont and Lansdale soils are likely to be channery and droughty if much of the soil material is removed by grading or construction work. The soils of this group are a source of topsoil of good quality, but the quantity is limited.

COMMUNITY DEVELOPMENT GROUP 3

In this group are mostly moderately deep, well-drained soils of the Brecknock, Glenelg, Lansdale, Manor, and Penn series, and areas of Made land, land fill and sediment basins. These soils are moderately or severely eroded, and their slopes range from 0 to 8 percent.

Most of these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Penn soils, however, have moderately rapid permeability. In most of the soils, depth to hard bedrock is between 2 feet and 12 feet, but in some areas of the Penn soils, bedrock is at a depth shallower than 2 feet. The very stony Manor soil contains stones and outcroppings of rock. The seasonal high water table is below a depth of 3 feet. The amount of moisture held available for plants is generally small. The

supply of moisture is estimated to be 3 to 7 inches in a root zone of 1½ to 3 feet.

These soils have slight or moderate limitations as sites for light industrial, commercial, institutional, and residential developments. The slopes, depth to a seasonal high water table, and permeability are favorable for developments. Grading can be done without difficulty, except in areas of the Manor very stony silt loam, which contains stones and ledges. The Manor, Glenelg, and Penn soils are unstable if they are disturbed, and they are subject to slumping and severe erosion, especially on the steeper slopes. The areas of Made land have severe limitations for residential developments, unless they are fill areas constructed for that purpose.

Most soils of this group have few limitations for use for foundations, but the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is somewhat elastic and unstable. Engineering tests should be made at the specific site to establish the suitability of those soils for heavy installations. Where an excavation is made in the soils of this group, some bedrock must be removed, but this is not difficult, except in the very stony Manor soil.

These soils have limitations ranging from slight to severe for use as a disposal field for the effluent from septic tanks. They are satisfactory for that purpose where the substratum is permeable and bedrock is at a depth of more than 4 feet deep below the tile floor. However, on-site percolation tests should be made.

These soils are only fair for farming, home gardens, and nurseries. They are fair to poor as a source of topsoil and are limited mostly by stones, shale, and stone fragments. Vegetation will grow in areas that have been disturbed, but the available moisture capacity is low and the hazard of erosion is serious. Mulching, adding topsoil, and applying lime and fertilizer help in establishing vegetation.

COMMUNITY DEVELOPMENT GROUP 4

This group consists of moderately deep to shallow, well-drained soils of the Brecknock, Glenelg, Lansdale, Manor, and Penn series. These soils have slopes of 8 to 15 percent. Most of them are moderately eroded.

Most of these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Penn soils, however, have moderately rapid permeability. In most places bedrock is at a depth of 2 to 3 feet, but the depth ranges from 1½ feet in the Penn and Brecknock soils to 12 feet or more in the Glenelg and Manor soils. The seasonal high water table is at a depth below 3 feet. The amount of moisture held available for plants is moderate to small. The supply of moisture is estimated to be 3 to 5 inches in a root zone of 1 to 5 feet.

Because of their strong slopes, these soils have moderate limitations for commercial, light industrial, institutional and residential developments. Nevertheless, the slopes, depth to a seasonal high water table, and permeability are generally favorable, and grading can be done with only minor interference from coarse fragments and bedrock. The Glenelg, Manor, and Penn soils, however, are unstable when disturbed. Soil creep, slippage, sheet erosion, and gullying may be severe unless adequate protection is provided.

These soils are generally good for foundations for small structures, but deep excavations require removal of the bedrock. Also, in some places the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is somewhat elastic and unstable, especially if it is removed and used as fill material. In some places removing the bedrock may create a problem if a road is built on these soils.

These soils vary in their limitations for use as a tile field for the disposal of effluent from septic tanks. They are well suited to that use in places where the subsoil is thick enough, where the substratum is permeable, and where bedrock is at a depth of at least 4 feet. Percolation tests should be made at the site, however, to determine suitability for this use. A large amount of effluent discharged in the more sloping areas causes surface seepage and saturation of the soils downslope.

These soils are only fair for farming, home gardens, nurseries, and lawns. They are good for grass and for landscape plantings. The soil limitations are moderate slopes, rapid runoff, susceptibility to erosion, and low available moisture capacity. The surface layer is thin, and it contains a number of coarse fragments in many places. Where these soils are disturbed, they are likely to be very channery or shaly, highly erodible, and droughty. In disturbed areas establishing vegetation satisfactorily requires protection from erosion, adding topsoil, mulching, and applying lime and fertilizer. In some places it also requires supplemental irrigation.

COMMUNITY DEVELOPMENT GROUP 5

This group consists of shallow to deep, well-drained soils that have slopes of 15 to 35 percent. Also included are very stony soils that have slopes of 8 to 25 percent. These soils are in the Brecknock, Edgemont, Glenelg, Klinesville, Lansdale, Manor, Neshaminy, and Penn series. Many of them are moderately or severely eroded.

In general, these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches per hour. The Edgemont, Penn, and Klinesville soils, however, have moderately rapid permeability. Surface drainage is rapid. Depth to hard bedrock is commonly 2 to 4 feet, but it ranges from 1½ feet in the Penn and Brecknock soils to 12 feet or more in the Manor and Glenelg soils. The seasonal high water table is below a depth of 3 feet. The amount of moisture held available for plants is small to moderate. The supply of moisture is estimated to be 3 to 7 inches in a root zone of 1 to 4 feet.

These soils have severe limitations of slope for commercial, light industrial, institutional, or densely populated residential developments. They are suitable for limited use for individual residences. The major limitations to development are the strong slopes, numerous stones, bedrock near the surface, susceptibility to soil creep, rapid surface drainage, susceptibility to erosion, and poor stability.

These soils are generally fair for foundations, but in some places the Manor and Glenelg soils are underlain by deeply weathered, highly micaceous material that is

somewhat elastic and unstable. The Neshaminy and Penn soils are unstable if they are disturbed, and they are subject to severe erosion. Deep excavations may make it necessary to remove the stones and bedrock.

The strong slopes and bedrock near the surface are moderate or severe limitations to use of these soils for tile fields for the disposal of effluent from septic tanks. The suitability of an individual site should be determined by making percolation tests and examining the local relief. If a large amount of water or effluent from septic tanks is added, these soils are likely to become saturated and seepage to the surface occurs farther downslope.

These soils are fair to good for trees, turf, and landscape plantings. They are generally poor for farming, home gardens, and lawns, and they have limited use for nurseries. The major limitations are the strong slopes, stones, rapid surface drainage, and droughtiness. The surface layer is thin, and it contains many coarse fragments or stones in many places. In disturbed areas establishing vegetation satisfactorily requires protection from erosion, adding topsoil, mulching, and applying lime and fertilizer. Also, supplementary irrigation is needed where it is feasible to use it.

COMMUNITY DEVELOPMENT GROUP 6

This group consists of shallow and very shallow, well-drained, moderately eroded or severely eroded soils of the Klinesville, Lansdale, and Penn series. The slopes range from 3 to 8 percent.

These soils have moderate or moderately rapid permeability and an estimated percolation rate of 0.63 inch to 6.3 inches per hour. Depth to bedrock is generally less than 2 feet, but it is as much as 3 feet in some areas of the Lansdale soil. The seasonal high water table is usually below a depth of 3 feet. The amount of moisture held available for plants is very small. The supply of moisture is estimated to be 1 to 4 inches in a root zone of 10 to 24 inches.

Bedrock near the surface is a limitation if these soils are used for residential, light industrial, commercial, or institutional developments. Grading is difficult because of the bedrock near the surface. These soils are generally stable, but they are subject to severe sheet and rill erosion. They are droughty. In many places shale or bedrock crops out on the surface after the areas are graded. As a result, final grading and landscaping are difficult.

These soils are good for foundations. All excavations, however, require removal of bedrock.

Although these soils are permeable, they have severe limitations if used as a disposal field for the effluent from septic tanks. Shale near the surface causes them to become saturated rapidly, and the effluent then seeps out and comes to the surface. Where the effluent sinks into cracks and fissures in the bedrock, it may cause contamination of the ground water because of inadequate filtration.

These soils are poor for farming, nurseries, home gardens, and turf. They are droughty, shaly, low in content of organic matter, and shallow over bedrock. Grass, shrubs, and trees cannot be readily established. Adding suitable topsoil, mulching, providing protection from erosion, and liming and fertilizing will all greatly aid in establishing sod and landscape plantings. Supplemental irrigation, where feasible, helps to establish and maintain the vegetation.

COMMUNITY DEVELOPMENT GROUP 7

This group consists of moderately deep to shallow or very shallow, well-drained soils that have slopes of 8 to 15 percent. These soils are severely eroded. They are in the Klinesville, Lansdale, Legore, and Penn series.

These soils are moderately permeable to rapidly permeable and have an estimated percolation rate of 0.63 inch to 6.3 inches per hour. Depth to bedrock ranges from 6 inches in the Klinesville soil to 3 feet in the Legore soil. Surface runoff is rapid. In most places the seasonal high water table is deep, but hillside seepage sometimes occurs late in winter or early in spring. The amount of moisture held available for plants is very small. The supply of moisture is estimated to be 1 to 4 inches in the variable depth of the root zone.

The strong slopes are a limitation if these soils are used for commercial, light industrial, or institutional developments. The soils also have limitations for homesites, but they can be used for that purpose. The buildings should be connected with a municipal facility for treating and disposing of sewage. Grading is difficult because of the bedrock near the surface. Also the exposed bedrock and large number of rock fragments and stones make vegetation hard to establish. In most places these soils are stable, but some soil creep can be expected in fill areas. Erosion is a hazard.

These soils are generally good for foundations, but excavations require the removal of bedrock. In some places the Legore and Lansdale soils are underlain by 2 or more feet of sandy loam.

These soils have severe limitations if they are used as a filter field for a septic tank. The soil material is permeable to a depth of ½ foot to 2 feet, but bedrock limits the depth of percolation. As a result, the soil becomes saturated and surface seepage occurs downslope. Even where the effluent seeps into cracks in the bedrock and surface seepage does not occur, contamination of the ground water is likely because the effluent has not had adequate filtration.

These soils are poor for farming, nurseries, home gardens, lawns, and landscape plantings. They are very low in content of organic matter, are shallow or very shallow over the underlying material, and are shaly and very droughty. Surface runoff is very rapid. Little or none of the original surface layer of these soils remains. After a development is established, the remaining soil material contains so much raw, broken rock or is so shallow to bedrock that grass, shrubs, and trees cannot be established easily. Adding topsoil, mulching, applying lime and fertilizer, and supplying extra water through supplemental irrigation greatly aid in establishing and maintaining vegetation.

COMMUNITY DEVELOPMENT GROUP 8

This group consists of well-drained soils of the Klinesville, Legore, and Neshaminy series. The Klinesville and Legore soils have slopes greater than 15 percent, and the Neshaminy soil has slopes between 0 and 8

percent. The Neshaminy soil is extremely stony, and the Klinesville soil is very shaly and shallow over bedrock. The Klinesville and Legore soils are severely eroded.

These soils have an estimated percolation rate of 2 to 6.3 inches per hour. Permeability is rapid in the Klinesville soil and moderate in the Legore and Neshaminy soils. Surface drainage is rapid or very rapid. In places in the Klinesville soil, bedrock is only 6 inches beneath the surface. The seasonal high water table is below a depth of 2 feet. The amount of moisture held available for plants is small or very small. The supply of moisture is estimated to be 1 to 6 inches in a root zone of 10 to 32 inches.

In most places these soils are too steep for commercial, industrial, institutional, or residential developments. In residential developments, they are more suitable for parks and for undeveloped recreational areas, wildlife preserves, and wooded areas than for other uses.

The bedrock underlying these soils is generally firm enough to provide a good foundation, but the areas where the slopes are steep require special investigation and design. Where the soils have been disturbed, they are subject to erosion, slumping, and severe slipping or soil creep. The large numbers of stones, bedrock near the surface, and steep slopes make grading and excavating difficult.

The steep slopes and bedrock near the surface are severe hazards to use of these soils for disposal fields for the effluent from septic tanks. Continuous moisture, such as that from septic tanks, saturates the soils downslope and causes surface seepage.

These soils are well suited to trees or to landscape plantings. The high content of shale and stone fragments, however, limits their use for turf. Also, the Klinesville soil is droughty, and the growth of roots is limited by the bedrock near the surface.

COMMUNITY DEVELOPMENT GROUP 9

In this group are moderately deep and deep, moderately well drained or somewhat poorly drained silt loams of the Beltsville, Glenville, Lawrenceville, Lehigh, Mount Lucas, Raritan, Readington, and Reaville series. Also included are areas of Made land. Some of these soils are moderately or severely eroded. Their slopes range from 0 to 8 percent.

Most of these soils have slow or moderately slow permeability and an estimated percolation rate of less than 0.2 to 0.63 inch per hour. Permeability of the Beltsville, Reaville, and Lehigh soils, however, ranges to very slow. Bedrock is commonly at a depth of 3 to 5 feet, but the depth ranges from 1 to 2 feet in the Reaville and Lehigh soils to 15 feet or more in the Beltsville soil. The seasonal high water table is generally between a depth of ½ foot and 2½ feet, but at times, it is at the surface in the Reaville soils and Made land. The amount of moisture held available for plants is moderate to large. In most of the soils the supply of moisture is estimated to be between 6 and 9 inches where the root zone is 2 to 5 feet thick. The Lehigh and Reaville soils are more droughty than the other soils and have from 3 to 5 inches of available moisture in the root zone.

Somewhat restricted drainage limits the use of these soils for commercial, light industrial, institutional, and residential developments. Buildings constructed on them should be connected to an adequate municipal sewage treatment system. The slopes and depth to bedrock are favorable for the different kinds of development. The major limiting factors are restricted permeability in the subsoil and a seasonal high water table. The water table remains high throughout the winter and early in spring, and it may remain high until early in summer if rainfall is above normal. Surface drainage is difficult where the soils have slopes of less than 3 percent.

Hard diabase stones and boulders in the very stony Mount Lucas soil, and shale and channers in the areas of Made land and the Reaville and Lehigh soils, interfere with grading. Where these soils are removed from their original location, they are unstable and are subject to frost heaving, slumping, severe surface erosion, and gullying.

Where these soils have not been disturbed, they are generally satisfactory for foundations. Excavating in the Lehigh and Reaville soils requires some quarrying of the bedrock, and excavating in the very stony Mount Lucas soil requires that the stones be removed. The seasonal high water table makes difficult the sealing and draining of basements or any other construction below the surface of the ground.

The soils of this group have severe limitations for use as filter fields for septic tanks. A seasonal high water table prevents normal operation of the system for weeks at a time. Also, restricted permeability limits the amount of effluent that can be disposed of. In summer the Readington and Glenville soils are satisfactory for filter fields for septic tanks if the fields are large and the amount of effluent is not excessive.

These soils are fair to good for farming, home gardens, nurseries, lawns, and landscape plantings, provided species that tolerate wetness are grown. The Reaville and Lehigh soils are usually too droughty in summer for the optimum growth of plants or for adequate yields of crops. Most of the soils of this group are a good source of topsoil, but the Reaville, Lehigh, moderately eroded phase of the Readington soils, and Made land are shaly or channery. Where the soils have been disturbed, they are likely to be severely compacted and have slower permeability than where they have not been disturbed. They contain many pieces of rock and are easily eroded.

COMMUNITY DEVELOPMENT GROUP 10

This group consists of deep or moderately deep to shallow, moderately well drained or somewhat poorly drained, mainly moderately eroded or severely eroded soils of the Lehigh, Mount Lucas, Readington, and Reaville series and areas of Made land. The slopes are mainly between 8 and 15 percent, but the very stony soils have slopes of 8 to 25 percent and are generally not eroded.

These soils have moderately slow permeability and an estimated percolation rate of 0.2 to 0.63 inch per hour. In most places bedrock is at a depth of 1 to 4 feet, but it is nearer the surface in some areas of the Reaville soil and Made land, and deeper in the Mount Lucas soils. Depth to the seasonal high water table is only about 1 foot in the Reaville soil, but the depth ranges to as much

as 30 inches in the Readington soil. The available moisture capacity is small or very small. The supply of moisture is estimated to be 1 to 5 inches in a root zone of 1 to 3 feet.

The slopes, slow permeability, seasonal high water table, and seeps are limitations for commercial, light industrial, institutional, or residential developments on these soils. The stones, shale, or channers make grading difficult. Seepage occurs on the lower part of the hillsides in winter and early in spring when the water table is high. These soils are subject to frost heaving, soil creep, and surface erosion. Where they are used as fill, they are unstable and easily eroded.

These soils are generally satisfactory for foundations for small buildings. In most places excavations require removal of the bedrock, however, and the very stony Mount Lucas soil contains many large diabase stones and boulders. The seasonal high water table, seeps, and moderately slow permeability make basements difficult to seal and drain.

Limitations are severe if these soils are used as a filter field for a septic tank. Any amount of water added continuously to these soils is likely to saturate them and cause surface seepage downslope. Also, the high water table prevents the normal operation of the system for many weeks at a time, and the restricted permeability of the subsoil and substratum limits the amount of effluent that can be disposed of. All buildings should be connected to an established central system for disposing of sewage.

These soils are fair to poor for farming, home gardens, and nurseries, and they are fair for landscape plantings, woodlots, and lawns. Plants that tolerate drought and that also tolerate periodic wetness should be selected. The surface layer is mostly thin and shaly, channery, or stony. These soils, whether in place or disturbed, need protection from erosion, additions of topsoil, mulching, and applications of lime and fertilizer. If the soils are used for lawns, the stones and fragments of rock must be removed. Light, frequent applications of water help to maintain the lawns during the dry summer months.

COMMUNITY DEVELOPMENT GROUP 11

This group consists of poorly drained or somewhat poorly drained soils that have slopes of 0 to 8 percent. These soils are in the Abbottstown, Chalfont, Croton, Doylestown, and Watchung series. Some of them are moderately eroded.

These soils are slowly permeable and have an estimated percolation rate of 0.2 to 0.06 inch per hour. In places the seasonal high water table is at the surface but it is as much as 1 foot deep in other places. Surface drainage is slow or very slow where the soils have slopes of 0 to 3 percent, and ponding occurs in the low-lying sites. The Croton, Doylestown, and Watchung soils have a high water table during the greater part of the year. Bedrock is at a depth of 3 to 8 feet. The amount of moisture held available for plants is moderate to small. The supply of moisture is estimated to be 3 to 7 inches in a root zone of 1 to 3 feet.

These soils have severe limitations of drainage for commercial, light industrial, institutional, or residential developments, but the slopes and depth to bedrock are favorable for those uses. The high water table, slow permeability, and poor stability restrict the use of the soils for developments. The soils of this group offer few limitations to grading during summer when the water table is low. Grading, however, leaves the soils highly compacted and subject to severe gully and surface erosion, frost heaving, and slumping. Also permeability is decreased and the water table may be closer to the surface after an area is graded.

The shrinking and swelling of the soil material, slow permeability, high water table, and poor stability limit the use of these soils as foundations for heavy structures. For lighter structures, a permeable and stable fill can be used to raise the foundation above the level reached by high water. The fill needs tile drainage to prevent water from rising into it.

These soils have severe limitations to use as a disposal field for the effluent from septic tanks. All buildings should be connected to a system that will adequately treat the sewage and dispose of it. Careful planning is needed to remove and dispose of the surface water.

These soils are poor for farming, home gardens, and nurseries. Turf, consisting of grasses and legumes that tolerate periodic wetness, grows well, except in the more poorly drained areas of the Watchung, Croton, and Doylestown soils. Shallow-rooted trees and shrubs are fair for landscape plantings. These soils have considerable value for open space conservation areas in conjunction with stream valley preserves, bird sanctuaries, and wildlife habitats.

COMMUNITY DEVELOPMENT GROUP 12

This group consists of well-drained to poorly drained soils on flood plains that are subject to periodic overflow. It consists of soils of the Bermudian, Bowmansville, Codorus, Hatboro, and Rowland series and of Bouldery alluvial land.

In most places these soils are moderately permeable and have an estimated percolation rate of 0.63 inch to 2 inches. However, permeability ranges from rapid in the Bermudian soil to slow in Bouldery alluvial land and in the Bowmansville and Hatboro soils. Depth to bedrock ranges from 3 to 8 feet. In places the seasonal high water table is at the surface, but it is at a depth of 2 feet in some of the soils and it is commonly at a depth of 3 feet in the Bermudian soil. At times, water is ponded on the surface of the Bowmansville and Hatboro soils. The amount of moisture held available for plants is moderate to large. The supply of moisture is estimated to be 6 to 12 inches in a root zone of 3 to 5 feet.

These soils are subject to flooding. Flooding may occur several times a year or only once in several years, and increase in the speed and volume of runoff, caused by covering large areas with buildings or pavement, may increase the frequency. As a result, flooding may be more frequent than the normal once in 3 to 5 years. The local alluvium phases of the Bowmansville and Rowland soils are not subject to normal flooding. In summer and fall, however, overflow of high velocity occurs for short periods during storms of high intensity.

Flooding and wetness are severe limitations, especially where these soils are used for commercial, residential, light industrial, or institutional developments. Normal flooding may result in extremely great damage to property if structures, built on these sites, are inundated. Though these soils are permeable and deep to bedrock, they have severe limitations for use as a filter field for the effluent from septic tanks. The seasonal high water table makes the system inoperable for weeks or months at a time, and contamination of the streams is likely to result.

The Bermudian, Rowland, and Codorus soils are fair to good for farming and home gardens. All of these soils, except the more poorly drained areas of Bowmansville and Hatboro soils, are suitable for turf and trees. These soils have considerable value for use as open spaces, such as golf courses, parks, wildlife habitats, recreational areas, and stream valley preserves.

COMMUNITY DEVELOPMENT GROUP 13

In this group is one miscellaneous land type, Stony land, steep, which has slopes of 25 to 80 percent. The steep slopes and the high content of stones severely limit the use of this land type for housing, agriculture, forestry, and most forms of recreation. The land has possibilities, however, for development as green areas for esthetic value in parks. It can also be used as a shelter for wildlife or as a part of a municipal watershed protection area.

Descriptions of the Soils

This section describes the soil series and the mapping units in Montgomery County. The procedure is first to describe each soil series, and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

The soil series contains a description of the soil profile, the major layers from the surface downward. This profile is considered typical, or representative, for all the soils of the series. If the profile for a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. Some technical terms are used in describing soil series and mapping units, simply because there are no nontechnical terms that convey precisely the same meaning. Many of the more commonly used terms are defined in the Glossary.

The acreage and proportionate extent of the mapping units are shown in table 9. Detailed technical descriptions of soil series are given in the section "Formation and Classification of Soils." At the back of the survey is a list of the mapping units in the county and the capability unit and community development group each is in. The page where each of these groups is described is also given.

TABLE 9.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Abbottstown silt loam, 0 to 3 percent slopes	4, 419	1. 4	Codorus silt loam	1, 580	0. 5
Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded	8, 569	2. 8	Croton silt loam, 0 to 3 percent slopes	4, 113	1. 3
Beltsville silt loam, 2 to 6 percent slopes, moderately eroded	312	. 1	Croton silt loam, 3 to 8 percent slopes, moderately eroded	6, 689	2. 1
Bermudian silt loam	492	. 2	Croton very stony silt loam, 0 to 8 percent slopes	278	. 1
Birdsboro silt loam, 0 to 3 percent slopes	387	. 1	Doylestown silt loam, 0 to 3 percent slopes	1, 537	. 5
Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded	330	. 1	Doylestown silt loam, 3 to 8 percent slopes, moderately eroded	552	. 2
Bouldery alluvial land	261	. 1	Duffield silt loam, 3 to 8 percent slopes, moderately eroded	2, 565	. 8
Bowmansville silt loam	11, 295	3. 6	Duffield silt loam, 8 to 15 percent slopes, moderately eroded	453	. 1
Bowmansville silt loam, local alluvium, 0 to 3 percent slopes	2, 214	. 7	Duffield silt loam, 8 to 15 percent slopes, severely eroded	150	(1)
Bowmansville silt loam, local alluvium, 3 to 8 percent slopes	1, 941	. 6	Edgemont channery loam, 3 to 8 percent slopes, moderately eroded	587	. 2
Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded	350	. 1	Edgemont channery loam, 8 to 15 percent slopes, moderately eroded	840	. 3
Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded	266	. 1	Edgemont channery loam, 15 to 25 percent slopes, moderately eroded	427	. 1
Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded	429	. 1	Edgemont very stony loam, 8 to 25 percent slopes	356	. 1
Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes	313	. 1	Glenelg silt loam, 3 to 8 percent slopes, moderately eroded	4, 157	1. 3
Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes	339	. 1	Glenelg silt loam, 8 to 15 percent slopes, moderately eroded	2, 115	. 7
Brecknock very stony silt loam, 8 to 25 percent slopes	365	. 1	Glenelg silt loam, 15 to 25 percent slopes, moderately eroded	210	. 1
Chalfont silt loam, 0 to 3 percent slopes	3, 948	1. 3	Glenville silt loam, 0 to 3 percent slopes	356	. 1
Chalfont silt loam, 3 to 8 percent slopes, moderately eroded	2, 592	. 8	Glenville silt loam, 3 to 8 percent slopes, moderately eroded	2, 072	. 7
Chester silt loam, 0 to 3 percent slopes, moderately eroded	252	. 1	Hatboro silt loam	2, 352	. 7
Chester silt loam, 3 to 8 percent slopes, moderately eroded	325	. 1	Howell silt loam, 3 to 8 percent slopes, moderately eroded	524	. 2

See footnote at end of table.

TABLE 9.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded	399	0. 1
Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded	1, 203	. 4
Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded	2, 013	. 6
Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded	3, 682	1. 2
Lansdale loam, thin, 3 to 8 percent slopes, severely eroded	2, 049	. 7
Lansdale loam, thin, 8 to 15 percent slopes, severely eroded	1, 316	. 4
Lansdale loam, thin, 15 to 35 percent slopes, severely eroded	1, 092	. 3
Lansdale silt loam, 0 to 3 percent slopes, moderately eroded	288	. 1
Lansdale silt loam, 3 to 8 percent slopes, moderately eroded	3, 991	1. 3
Lansdale silt loam, 8 to 15 percent slopes, moderately eroded	376	. 1
Lawrenceville silt loam, 0 to 3 percent slopes	7, 462	2. 4
Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded	6, 329	2. 0
Legore clay loam, 8 to 15 percent slopes, severely eroded	81	(1)
Legore clay loam, 15 to 30 percent slopes, severely eroded	152	(1)
Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded	466	. 1
Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded	5, 417	1. 7
Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded	1, 457	. 5
Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded	2, 368	. 8
Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded	1, 359	. 4
Lehigh very stony silt loam, 0 to 8 percent slopes	413	. 1
Lehigh very stony silt loam, 8 to 25 percent slopes	691	. 2
Made land, diabase, gabbro materials	244	. 1
Made land, land fill and sediment basins	885	. 3
Made land, limestone materials	6, 885	2. 2
Made land, schist and gneiss materials, sloping	17, 715	5. 6
Made land, schist and gneiss materials, strongly sloping	6, 124	1. 9
Made land, shale and sandstone materials, sloping	27, 631	8. 8
Made land, shale and sandstone materials, strongly sloping	1, 932	. 6
Manor channery silt loam, 3 to 8 percent slopes, moderately eroded	968	. 3
Manor channery silt loam, 8 to 15 percent slopes, moderately eroded	2, 706	. 9
Manor channery silt loam, 15 to 35 percent slopes, moderately eroded	3, 339	1. 1
Manor very stony silt loam, 0 to 8 percent slopes	103	(1)
Manor very stony silt loam, 8 to 25 percent slopes	1, 288	. 4
Mount Lucas silt loam, 0 to 3 percent slopes	154	(1)
Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded	2, 490	. 8
Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded	423	. 1
Mount Lucas very stony silt loam, 0 to 8 percent slopes	2, 336	. 7
Mount Lucas very stony silt loam, 8 to 25 percent slopes	1, 539	. 5
Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded	245	. 1
Neshaminy extremely stony silt loam, 0 to 8 percent slopes	274	0. 1
Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded	1, 047	. 3
Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded	928	. 3
Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded	188	. 1
Neshaminy very stony silt loam, 0 to 8 percent slopes	1, 028	. 3
Neshaminy very stony silt loam, 8 to 25 percent slopes	2, 790	. 9
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded	904	. 3
Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded	800	. 3
Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded	854	. 3
Penn silt loam, 0 to 3 percent slopes, moderately eroded	288	. 1
Penn silt loam, 3 to 8 percent slopes, moderately eroded	4, 212	1. 3
Penn silt loam, 3 to 8 percent slopes, severely eroded	7, 019	2. 2
Penn silt loam, 8 to 15 percent slopes, moderately eroded	1, 070	. 3
Penn silt loam, 8 to 15 percent slopes, severely eroded	5, 117	1. 6
Penn very stony silt loam, 8 to 25 percent slopes	151	(1)
Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded	1, 563	. 5
Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded	4, 163	1. 3
Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded	884	. 3
Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded	731	. 2
Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded	686	. 2
Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded	457	. 1
Raritan silt loam, 0 to 3 percent slopes	1, 061	. 3
Raritan silt loam, 3 to 8 percent slopes, moderately eroded	652	. 2
Readington silt loam, 0 to 3 percent slopes	6, 894	2. 2
Readington silt loam, 3 to 8 percent slopes, moderately eroded	33, 060	10. 6
Readington silt loam, 8 to 15 percent slopes, moderately eroded	1, 814	. 6
Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded	2, 375	. 8
Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded	12, 712	4. 0
Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded	8, 956	2. 9
Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded	5, 030	1. 6
Rowland silt loam	5, 290	1. 7
Rowland silt loam, coal overwash	1, 509	. 5
Rowland silt loam, local alluvium, 0 to 3 percent slopes	458	. 1
Rowland silt loam, local alluvium, 3 to 8 percent slopes	378	. 1
Stony land, steep	3, 150	1. 0
Watchung silt loam, 0 to 3 percent slopes	605	. 2
Watchung silt loam, 3 to 8 percent slopes	847	. 3
Watchung very stony silt loam	2, 579	. 8
Mines and pits	793	. 3
Total	314, 240	100. 0

[1] Less than 0.05 percent.

Abbottstown Series

In the Abbottstown series are deep and moderately deep, somewhat poorly drained soils formed in material weathered from red and brown shale and sandstone. These soils have a slowly permeable subsoil that impedes the downward movement of water. They are nearly level or gently sloping and occur on upland flats, in depressions, and on concave lower slopes in the northern two-thirds of the county.

The Abbottstown soils occur with the moderately well drained Readington soils and the poorly drained Croton soils. Near the Abbottstown soils, but on higher uplands and steeper slopes, are well-drained, reddish-brown Penn soils and brown Lansdale soils.

In a typical profile of an Abbottstown soil, the surface layer is friable, dark-brown or dark reddish-gray silt loam. It is 10 to 11 inches thick and contains a few pieces of shale. The pieces of shale and sandstone increase in number with increasing depth.

The subsoil is reddish-brown or weak-red silt loam or silty clay loam with many gray or strong-brown streaks and mottles. At a depth of 12 to 20 inches, it is slightly firm. If the soil is disturbed, the subsoil breaks to thin, flat pieces, or plates. A firm, dense layer, at a depth of 20 to 40 inches, impedes the downward movement of water and the growth of roots. About 25 percent, by volume, of the lower part of this dense layer consists of fragments of shale.

At a depth of about 40 inches, the material in the subsoil grades to the substratum of reddish-brown or weak-red shaly silt loam. In many places the substratum is mottled with gray. Dusky-red shale bedrock is at a depth of 4 to 5 feet, but the depth ranges from 3 to 8 feet.

The Abbottstown soils are wet late in fall, in winter, and early in spring. Their ability to hold moisture available for plants is high, but the growth of roots is restricted by the dense subsoil. These soils are medium acid to very strongly acid. They are fairly well suited to hay and pasture consisting of grasses and shallow-rooted legumes that tolerate wetness. The unstable soil material, very slow permeability, and seasonal high water table are limitations to use of these soils for developments.

Abbottstown silt loam, 0 to 3 percent slopes (AbA).—This soil is on low-lying flats and in depressions scattered throughout the northern two-thirds of the county. In most places it has a profile like the one described as typical for the series.

In some areas of this soil in the central part of the county, the upper part of the subsoil is very silty, is yellowish brown and gray, and is almost free of shale. The subsoil in those areas is shaly at a depth of 24 to 30 inches, and it contains more clay than the soil material at a comparable depth in the profile described as typical for the series. In the south-central part of the county, especially south of Norristown and Ambler, this soil contains considerable sand and has pieces of sandstone below a depth of 18 to 30 inches. In some places in depressions and in shallow drainageways, this soil has a dark-colored surface layer as thick as 18 inches.

Included with this soil in mapping are very small areas of Croton silt loam, 0 to 3 percent slopes, and of Abbottstown silt loam, 3 to 8 percent slopes.

Permeability is very slow, and the water table is within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is slow, and ponding is common in low-lying pockets late in winter. This soil dries slowly in spring. After a long period of heavy rainfall, it is wet for several days at a time during the growing season. The hazard of erosion is slight. This soil has high moisture-holding capacity, but plants cannot use all of the moisture, because their roots are restricted by the dense subsoil.

This soil is used for the commonly grown field crops and for hay and pasture (fig. 15). Also, in open residential areas near towns, much of it is idle or is in turf associated with golf courses, industries, institutions, and estates. This soil is only fair for corn, soybeans, and spring-planted small grains. Alfalfa and winter grains are likely to be seriously injured by the high water table and by frost heaving.

A suggested cropping system is 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties. Such a cropping system, where graded-row cultivation is practiced, improves surface drainage, reduces losses from erosion, and maintains good tilth. Constructing a diversion terrace on the slope above areas of this soil may reduce wetness caused by seeps, springs, or excess surface water. Open drains help to remove the excess water from low-lying pockets.

This soil has severe limitations for residential, light industrial, commercial, and institutional developments. It also has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–2, woodland suitability group 7, community development group 11)

Abbottstown silt loam, 3 to 8 percent slopes, moderately eroded (AbB2).—The surface layer in this gently sloping soil is thinner and contains more fragments of shale than the one in the profile described as typical for the series. This soil is on broad undulating and smooth uplands. The areas are large and are scattered throughout the northern two-thirds of the county.

In areas of this soil in the central part of the county, brown or yellowish-brown colors are predominant, but reddish colors are most common in the northern half. South of Norristown and Ambler, the profile of this soil is more sandy than the one described as typical for the series, and it contains some gravel and pieces of sandstone. Near Lansdale and east to the Bucks County line, this soil is very silty and contains only a few fragments of shale above a depth of 2 or 3 feet. At higher elevations, it is shaly. Up to 90 percent of the soil material is shale at a depth of 30 to 36 inches.

Included with this soil in mapping are small areas that are in depressions and that have a dark-colored surface layer as thick as 12 to 15 inches. On some slopes bedrock is at a depth of only 3 feet. In some very small areas, it is at a depth of only 2 feet. In many places the surface layer is only about 6 inches thick and contains gray and yellowish or reddish streaks where material from the subsoil has been mixed into it. Small areas of slightly eroded and of severely eroded soils are also included.

This Abbottstown soil is slowly permeable and has a water table within 12 inches of the surface during winter and early in spring. Surface drainage is medium to rapid.

Figure 15.—A field in which Abbottstown silt loam, 0 to 3 percent slopes, is used for hay and pasture. Readington soils are also in this field. Bowmansville soils are along a small stream below the barn, and Croton soils are in the pasture beside the barn.

The hazard of erosion is mostly moderate, but it ranges to severe on long slopes that have a gradient of 6 to 8 percent. The moisture-holding capacity is high, but not all of the moisture can be used by plants, because the growth of roots is restricted in the subsoil.

This soil is used for the commonly grown field crops and for hay and pasture. In open residential areas near towns, much of it is idle, is in nurseries or in permanent grass on golf courses, or is used for industrial or institutional developments. This soil is fair for cultivated crops and small grains seeded in spring. Alfalfa and winter small grains, however, are likely to be severely damaged by the seasonal high water table and frost heaving.

Graded contour stripcropping and a cropping system made up of 1 year of a row crop followed by a cover crop, 1 year of a spring-seeded small grain, and at least 3 years of grass-legume hay of adapted varieties are suggested for the long slopes. The stripcropping and this cropping system help to reduce losses from erosion, remove excess surface water, and maintain good soil tilth. Diversion terraces safely remove additional surface water; they may also be used to intercept subsurface seepage so that small, wet areas will receive less water.

This soil has severe limitations if it is used for residential, light industrial, commercial, and institutional developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–3, woodland suitability group 7, community development group 11)

Beltsville Series

In the Beltsville series are deep, moderately well drained or somewhat poorly drained, gently sloping soils formed in deposits of silt, clay, sand, or gravel. These soils have a slowly permeable layer in the subsoil that impedes the downward movement of water. They are on upland benches and in depressions on old coastal plain terraces in the south-central part of the county near Conshohocken.

The Beltsville soils occur with the deep, well-drained Howell soils, and they formed in similar material. They also occur with the silty, moderately well drained Lawrenceville soils and the somewhat poorly drained Chalfont soils. Near them are the well-drained Duffield soils that are underlain by limestone.

In a typical Beltsville soil, the plow layer is friable, dark grayish-brown silt loam that is 8 to 9 inches thick.

The upper part of the subsoil is dark yellowish-brown silt loam or gritty silty clay loam mottled with brown. In most places the lower part of the subsoil is more reddish and more clayey than the upper part, and it contains less silt and more sand and gravel. At a depth

of about 21 inches, the subsoil consists of reddish-brown, very firm silty clay loam or clay loam mottled with gray. If this very firm layer is disturbed, it breaks to large columns, called prisms, that readily break to smaller blocks and plates. This part of the subsoil is dense and compact. The subsoil is about 30 inches thick. As much as 30 percent of it is rounded gravel.

The substratum consists of about 30 inches of sandy clay loam. This layer is transitional to gravel, and about 50 percent of it is gravel. Bedrock is generally about 10 feet below the surface, but the depth ranges from 4 to 30 feet.

These soils are slowly permeable and are wet late in fall, during winter, and early in spring. They have high available moisture holding capacity, but their dense subsoil restricts the growth of roots. Also, they are slow to warm in spring and are wet until April or May. The soils are strongly acid. They are well suited to hay and pasture and are fair for corn, soybeans, and spring-seeded small grains. The seasonal high water table and slow permeability are limitations to use of these soils for residential, commercial, light industrial, or institutional developments.

Beltsville silt loam, 2 to 6 percent slopes, moderately eroded (BlB2).—This is the only Beltsville soil mapped in the county. It is in small, gently sloping areas on upland benches and in depressions, at a slightly lower elevation than the well-drained Howell soils. In general, the profile of this soil is like the one described for the series. In some places, however, where this soil is in depressions and has not been affected by erosion, the surface layer is as much as 18 inches thick.

Included with this soil in mapping are small areas of poorly drained soils formed in material similar to that in which these soils developed. Areas of soils that are more reddish than normal for the Beltsville soils are also included.

Permeability is slow, and the water table is at a depth of only ½ to 2½ feet late in fall, in winter, and early in spring. Surface drainage is slow to medium, and there is a moderate hazard of erosion. The moisture-holding capacity is high, but plants cannot use all of the moisture, because the dense subsoil restricts the growth of their roots.

This soil is mostly idle and is overgrown with weeds and brush. Some areas, however, are planted to corn, soybeans, and small grains. This soil is well suited to hay and pasture, and it is fair for corn, soybeans, and spring-seeded small grains. Winter small grains and alfalfa are damaged by the high water table and by frost heaving in winter.

Moisture can be conserved, losses from erosion reduced, excess surface water removed, and good tilth maintained by farming this soil in field or graded strips. The cropping system should consist of 2 years of row crops and a cover crop, 1 year of a spring-seeded small grain, and 2 or 3 years of grass-legume hay. Random tile drains are effective in reducing wetness in depressions and seeps.

This soil has limitations for residential, light industrial, commercial, and institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Bermudian Series

The Bermudian series consists of deep, well-drained, brown or reddish-brown soils on flood plains. These soils formed in material washed from uplands underlain by red shale and sandstone. They are level or nearly level and occur in small areas along the larger streams in the county.

The Bermudian soils occur on flood plains with the moderately well drained to somewhat poorly drained Rowland soils and the poorly drained Bowmansville soils. Nearby, on uplands, are reddish-brown, well-drained Penn soils, brown, well-drained Lansdale soils, and moderately well drained Readington soils.

In a typical profile of a Bermudian soil, the surface layer is friable, dark-brown loam or silt loam about 10 inches thick. The surface layer is underlain by layers of variable soil material, called the substratum.

Typically, the substratum is friable, dark-brown and reddish-brown silt loam or loam. In many places, however, it is stratified and contains considerable sand. Shale bedrock is at a depth of about 5 feet, but the depth to bedrock ranges from 4 to 8 feet.

These are medium acid or slightly acid, moderately permeable soils. They have high available moisture capacity and moderate to high natural fertility.

These soils are well suited to the crops commonly grown in the area, but the size of an area is likely to determine its use. Many of the small or odd-shaped areas are used for pasture. Because of the occasional floods, limitations to use of these soils are severe for residential developments.

Bermudian silt loam (Bm).—This is the only soil of the Bermudian series mapped in this county. Its profile is the one described as typical for the series. This soil is in small, scattered bands along the channels of Skippack and Perkiomen Creeks and along other large streams in the northern two-thirds of the county. Along the edges of some areas, this soil merges with Rowland or Bowmansville silt loams. In those places flooding is more frequent and this soil cannot be worked so early in spring as in other areas. A few wet spots are mapped with this soil.

This soil has moderate permeability, but the water table is within 3 feet of the surface in winter and early in spring. The frequency of flooding ranges from once in several years to once each winter or once early in spring. The available moisture capacity is high. This soil has benefited from lime and fertilizer washed from nearby fields. The hazard of erosion is slight.

Because the areas are small and access to them is obstructed by areas of poorly drained Bowmansville soils, this soil is used primarily for pasture. It is well suited to corn, soybeans, and late-planted vegetables, however, and to alfalfa, orchardgrass, and other deep-rooted grasses and legumes. Winter small grains are sometimes damaged by flooding.

Susceptibility to occasional flooding is a severe limitation to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability

unit I–1, woodland suitability group 1, community development group 12)

Birdsboro Series

In the Birdsboro series are deep, well-drained, reddish-brown silt loams or silty clay loams. These soils formed in old stream sediments washed from uplands underlain by red shale and sandstone. They are at elevations well above the present level of the streams and are above the flood plains occupied by Bermudian, Rowland, and Bowmansville soils. The Birdsboro soils are nearly level or gently sloping. They occupy small, scattered areas along the major waterways in the northern part of the county.

The Birdsboro soils are deeper, less shaly, and more gravelly than the Penn soils. They are not so brown and lack the gray mottling typical of the moderately well drained to somewhat poorly drained Raritan soils that occur on similar stream terraces. The Birdsboro soils are less shaly and lack the firm, slowly permeable layer in the lower part of the subsoil that is typical of the moderately well drained Readington soils.

In a typical profile of a Birdsboro soil, the surface layer is friable, dark reddish-brown silt loam that is about 8 inches thick. It contains a few river pebbles.

The subsoil is friable, reddish-brown silty clay loam or clay loam. It is 2½ to 3 feet thick.

The substratum is red or reddish-brown sandy loam that is about 2 feet thick and contains considerable gravel. The sandy loam overlies a layer of firm, dusky-red silt loam weathered from the underlying rock. This weathered material grades to soft, weathered, dusky-red shale bedrock at a depth of about 7 feet. Depth to bedrock, however, ranges from 4 to 15 feet.

These are very strongly acid or medium acid soils that are moderately permeable. They have high available moisture capacity and moderate to low natural fertility. Limitations are few if they are used for growing field crops, vegetables, or hay, or if they are used for pasture.

These soils have few limitations to use for residential developments. The areas are small, however, and in many places these soils occur with slowly permeable soils that have a seasonal high water table.

Birdsboro silt loam, 0 to 3 percent slopes (BnA).—This is the soil described as typical for the series. It is on benches scattered along the Schuylkill River and on upland flats along Swamp and Perkiomen Creeks in the northern part of the county. The soil is not extensive, but it is important to the agriculture of this area because it is deep and well drained.

Included with this soil in mapping are small areas in which the plow layer is brown or reddish brown and is only about 6 inches thick. In places as much as 30 percent of the plow layer is gravel. The soil material in some small patches or streaks is only 24 to 36 inches deep over partly weathered, dusky-red shale.

This Birdsboro soil is moderately permeable and has a seasonal high water table that rarely rises to within 4 feet of the surface, even early in spring. The available moisture capacity is high, and the hazard of erosion is slight.

This soil is well suited to corn, wheat, barley, alfalfa, and orchardgrass, and it is used mainly for field crops, including winter small grains. A suitable cropping system for conserving moisture, reducing losses from erosion, and maintaining good tilth and the content of organic matter consists of 2 years of row crops, 1 year of a winter small grain, and at least 1 year of deep-rooted grasses and legumes grown for hay. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil has few limitations to use for residential, light industrial, institutional, or commercial developments. The areas are small, however, and in many places this soil occurs with areas of less permeable soils that have an objectionable high water table. (Capability unit I–2, woodland suitability group 2, community development group 1)

Birdsboro silt loam, 3 to 8 percent slopes, moderately eroded (BnB2).—This soil has a brown or reddish-brown plow layer that is 6 to 8 inches thick. In some places as much as 30 percent of the plow layer is gravel, but much of the gravel is concentrated on the surface. Dusky-red underlying material or shale bedrock is normally at a depth of 4 to 6 feet. This gently sloping soil is on upland benches along the Schuylkill River and Perkiomen Creeks.

Included with this soil in mapping are a few small areas in which the plow layer is darker and thicker than typical. Also included are narrow bands in which shale bedrock is within 24 to 30 inches of the surface.

This Birdsboro soil is moderately permeable and has high available moisture capacity. Erosion is the main hazard in cultivated areas.

This soil is well suited to corn, wheat, barley, vegetables, alfalfa, and orchardgrass. It is used mainly for field crops, including winter small grains, and hay. A suitable cropping system, used with field or contour stripcropping, consists of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay. Crops grown on this soil respond well to moderate, frequent applications of lime and fertilizer. Diversion terraces may be needed on the long slopes to safely carry away excess surface water.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. The areas are generally small and scattered, and they are surrounded in places by soils that are undesirable for developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Bouldery Alluvial Land

Bouldery alluvial land (Bo) consists of nearly level and gently sloping areas covered mostly by boulders and stones. It is on flood plains along creeks and waterways in the northern and southwestern parts of the county. The areas in the northern part of the county are covered by large diabase boulders and stones that in some places exceed 12 feet in diameter. These areas occur along Unami Creek and similar waterways with the poorly drained Bowmansville soils and moderately well drained or somewhat poorly drained Rowland soils. The areas in the southern part of the county are small. They are scattered along the narrow bottom lands of streams in steep-walled ravines.

Bouldery alluvial land occurs with the poorly drained Hatboro and moderately well drained or somewhat poorly drained Codorus soils. It varies mainly in the size, number, and kinds of stones and boulders. Included with it in mapping are areas of stone-free soils that are also on flood plains and that are too small to be mapped separately.

This land type is subject to periodic flooding; flooding usually occurs several times each year. Permeability is moderate, but the water table is near or at the surface late in fall and during winter and spring. The supply of moisture held available for plants is low.

This land type is in sparsely wooded areas in parks, camps, farms, and estates. It is too bouldery and stony for farming or for the production of timber. Limitations to its use for residential developments are the hazard of flooding and the large number of boulders and stones. (Capability unit VIIIs–1, woodland suitability group 12, community development group 12)

Bowmansville Series

Deep, poorly drained, gray or grayish-brown silt loams or silty clay loams make up the Bowmansville series. These soils formed in material washed from uplands underlain by shale, sandstone, and diabase. They are nearly level or gently sloping and occur along streams and waterways in the northern two-thirds of the county.

Typically, these soils occur on flood plains with moderately well drained or somewhat poorly drained Rowland soils. They are downslope from the poorly drained Croton soils and the somewhat poorly drained Abbottstown soils. The Bowmansville soils are somewhat deeper over bedrock and have a more friable subsoil than the Croton and Abbottstown soils.

In a typical profile of a Bowmansville soil, the surface layer is friable, dark reddish-brown silt loam mottled with weak red and grayish brown. The surface layer is about 10 inches thick.

The upper part of the subsoil is weak-red silt loam that is mottled with reddish brown and gray and is about 6 inches thick. The lower part of the subsoil is also weak-red silt loam, but it is mottled with yellowish red and gray. It extends to a depth of about 3 feet.

Bedrock is dusky-red shale or brown sandstone. Depth to bedrock ranges from 3 to 8 feet, but it is generally about 4 feet.

These soils are strongly acid and have moderate permeability. The water table is at the surface late in fall, in winter, and in spring. Available moisture capacity is moderate, and natural fertility is moderate to low.

These soils are better suited to pasture than to field crops. They have limitations to use for residential developments but are valuable if they are retained as open land or used for bird sanctuaries or wildlife habitats.

Bowmansville silt loam (Bp).—This is the soil described as typical for the series. It is in small areas on flood plains at the base of slopes and is widely scattered throughout the northern two-thirds of the county.

This soil is on the same flood plains as those on which the Rowland soils occur. Where this soil lies along the edges of the flood plains, it merges with the Croton and Abbottstown soils that have similar slopes. It is adjacent to uplands occupied by the steeper Penn and Klinesville soils.

Included with this soil in mapping are small areas in which bedrock is within 2 to 3 feet of the surface. Some small areas are more sandy throughout than the typical soil.

Permeability is moderate, and this soil has slow surface drainage and is frequently flooded. The available moisture capacity is high. The water table is near the surface or water is ponded on the surface late in fall, in winter, and in spring. The water table is also high for several days following floods or extended wet periods during the growing season. The hazard of erosion is slight.

This soil is used primarily for pasture. It is poorly suited to small grains and alfalfa and is also poorly suited to corn, unless the surface water can be removed readily by installing open drains. Even after surface drains are installed, flooding is still a hazard during the growing season. This soil is well suited to permanent pasture of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit VIw–1, woodland suitability group 8, community development group 12)

Bowmansville silt loam, local alluvium, 0 to 3 percent slopes (BrA).—In places this soil has a thicker, darker surface layer than the one in the profile described as typical for the series. It occupies small, scattered areas at the heads of streams and in drainageways above the normal level of the flood plain (fig. 16). This soil is seldom flooded for any significant length of time. Flooding generally occurs for only a short period after a storm of high intensity. This soil formed in material eroded from the adjacent uplands and deposited on low-lying flats and in depressions and drainageways.

This soil has moderate permeability. Surface drainage is slow or ponded, and a seasonal high water table is at the surface or above the surface late in fall, in winter, and early in spring.

This soil generally occurs in small areas; therefore the cropping system is normally the same as that used for surrounding soils. The soil is well suited to perennial hay or pasture consisting of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes. It is fair to poor for corn and poor for alfalfa and small grains. Drainage can be improved by installing open drains and tile drains if outlets are available. If planting is delayed until the period of excessive moisture has passed in spring, this soil is suited to an occasional row crop that requires only a short period to mature.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Bowmansville silt loam, local alluvium, 3 to 8 percent slopes (BrB).—This soil is reddish brown and is mottled with gray. It contains more shale than the soil for which a profile is described as typical for the series. This soil occurs in narrow bands at the heads of streams and in drainageways above the normal level of the flood plain. It formed in material that was eroded from the nearby uplands and deposited in depressions and on the lower slopes. Included with this soil in mapping are small areas in which bedrock is at a depth of only 2 to 3 feet.

Figure 16.—**Area of Bowmansville silt loam, local alluvium, 0 to 3 percent slopes, in a narrow drainageway at the head of a stream. The gentle slopes to the right are occupied by Abbottstown and Readington soils.**

Permeability is moderate, and surface drainage is medium. A seasonal high water table is at the surface late in fall, in winter, and early in spring. This soil is seldom flooded for long periods. It is flooded for short periods after storms of high intensity that occur mainly during the growing season.

Because this soil occurs in narrow areas, the cropping system is usually the same as that used for the surrounding soils. This soil is well suited to perennial hay and pasture consisting of birdsfoot trefoil, reed canarygrass, and other shallow-rooted grasses and legumes. It is fair for corn and for small grains planted in spring, but it is poorly suited to alfalfa and winter small grains. Occasionally, a row crop or a small grain planted in spring may be included in a cropping system in which hay is grown most of the time. Tile help to remove the excess water that accumulates in the soil in spring. It also reduces the amount of water that flows from seeps and springs that persist during the growing season.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Brecknock Series

The Brecknock series consists of deep to moderately deep, well-drained, dark grayish-brown channery silt loams. These soils developed on hard, gray or black metamorphosed shale, called hornfels. They are gently sloping to steep and are on broad-topped hills and low ridges in the northern part of the county.

Adjacent to these soils are the moderately well drained or somewhat poorly drained Lehigh and poorly drained Croton soils. On nearby uplands are the Neshaminy and Mount Lucas soils, formed on diabase, and the Penn and Reaville soils, formed on red shale.

In a typical profile of a Brecknock soil, the surface layer is friable, very dark grayish-brown channery silt loam about 8 inches thick. Channers, or fragments of flat rock, make up about 30 percent of this layer.

The subsoil is friable, dark grayish-brown or olive-brown channery silt loam or silty clay loam about 26 inches thick. The content of channers ranges from 35 percent in the upper part of the subsoil to nearly 90 percent in the lower part.

The substratum consists mainly of broken pieces of rock with dark grayish-brown and olive-brown silt loam between the pieces. Depth to bedrock is generally about 4 feet, but it ranges from 2 to 5 feet.

Permeability is moderate, and the available moisture capacity is low to high, depending upon the depth to bedrock. The soils are very strongly acid or strongly acid and have low natural fertility. They vary considerably in their suitability for certain crops and for specific uses in residential areas.

Brecknock channery silt loam, 3 to 8 percent slopes, moderately eroded (BsB2).—This soil is less steep than the one described as typical for the series. Also, it has a slightly thicker surface layer and subsoil, and typically, it contains fewer rock channers. It is in scattered, small areas on undulating broad hilltops and gently sloping ridges throughout the northern third of the county.

In some places this soil occurs near Reaville, Penn, and Neshaminy soils. Where it occurs near the Reaville and Penn soils, it is redder than typical for this series and its color approaches a dark reddish gray. Where this soil is near the Neshaminy soils, its color is olive brown or olive gray.

Included with this soil in mapping are small wooded areas in which there is a mulch of partly rotted leaves on the surface. Below the leaves, 1 to 2 inches of very dark gray silt loam and 4 to 6 inches of dark grayish-brown channery silt loam overlie the subsoil. In a few places, the subsoil is brown silt loam that is nearly free of coarse fragments to a depth of 3 to 4 feet.

This Brecknock soil has moderate permeability and moderate available moisture capacity. Surface drainage is medium, and the hazard of erosion is moderate. Natural fertility is low.

This soil is used for the commonly grown field crops, small grains, and hay. To a lesser extent, it is used for pasture and for a few orchards and woodlots. The soil is fairly well suited to small grains, hay, and pasture. It is less well suited to corn, alfalfa, and fruit because of the small supply of moisture during August and September. If water is available, supplemental irrigation helps to maintain good yields and improves the quality of the crops. Where lime and fertilizer are applied, moderate, frequent applications are generally preferred to larger, less frequent ones.

To reduce runoff and to provide protection from erosion, field or contour stripcropping is needed on most fields made up of this soil. A suitable cropping system is one in which row crops and small grains are grown for 1 year each and then grasses and legumes are grown for at least 2 years. It is important to maintain the content of organic matter by growing a cover crop, adding manure, and returning crop residue to the soil.

Bedrock fairly near the surface is a limitation to most uses of this soil for residential developments. Suitability for use as a disposal field for the effluent from septic tanks needs to be determined. This can be done by properly conducting percolation tests where the depth of the soil is adequate. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Brecknock channery silt loam, 8 to 15 percent slopes, moderately eroded (BsC2).—This soil is on hills and ridges in the northern third of the county. It is less steep than the soil for which a profile is described as typical for the series. In some places this soil occurs near Penn, Reaville, and Neshaminy soils. Where it is near the Penn and Reaville soils, it is redder than typical for this series and its color approaches a dark reddish gray. Where it is near the Neshaminy soils, its color is olive brown or olive gray.

Included with this soil in mapping are small wooded areas in which a mulch of partly rotted leaves overlies 2 to 3 inches of very dark gray channery silt loam. Beneath the channery silt loam is 5 to 7 inches of very dark grayish-brown channery silt loam. Also included, on some of the lower slopes, are areas in which the surface layer is 8 to 12 inches thick.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface drainage is medium to rapid, and the hazard of erosion is moderate. Natural fertility is low.

This soil is used for the commonly grown field crops, hay, pasture, fruit, and woodlots. About a third of it is idle and is overgrown with weeds, brush, and cedar trees. The soil is suitable for hay or pasture of drought-resistant grasses and legumes, but is is only fair for corn and winter small grains. Contour stripcropping and a cropping system consisting of 1 year of a row crop, 1 year of a small grain, and 3 or 4 years of hay help to reduce erosion and conserve moisture. The soil can be kept in good tilth by growing a cover crop, adding manure, and incorporating crop residue into it. Where lime and fertilizer are applied, moderate, frequent applications are generally better than larger, less frequent ones.

Bedrock fairly near the surface is a limitation if this soil is used for residential developments or as a disposal field for the effluent from septic tanks. Depth to bedrock should be determined and percolation tests ought to be made at the specific site if a residential development is planned. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded (BsD2).—The profiile of this soil is the one described as typical for the series. This soil is on hills and ridges in the northern third of the county. In some places it occurs near Penn, Klinesville, and Neshaminy soils. Where it is near the Penn and Klinesville soils, its color ranges to dark reddish gray. Where it is near the Neshaminy soils, its color is olive gray.

Included with this soil in mapping are small wooded areas in which there is a thin layer of partly rotted leaves over 5 to 7 inches of very dark gray channery silt loam. Also included are small areas of Lehigh soils that have similar slopes. Outcrops of bedrock and areas that have many channers on the surface occur near gullies.

This soil has moderate permeability and low to moderate available moisture capacity. Surface drainage is rapid, and the hazard of erosion is severe. Natural fertility is low.

Most of this soil is in young trees that are overcrowded and even aged, or it is overgrown with weeds, brush, and cedar trees. A small acreage is used for the commonly grown field crops and for hay and pasture. The soil is fairly well suited to perennial hay, pasture, and trees and to birdsfoot trefoil, reed canarygrass, tall fescue, smooth bromegrass, and other legumes and grasses that resist drought. It is poorly suited to corn, small grains, and alfalfa.

The hayfields and pastures should be reseeded in alternate field strips or contour strips. Half the strips ought to be planted the first year and the rest the following year. Where lime and fertilizer are applied, moderate, frequent applications are better than larger, less frequent ones. The pastures ought to be rotated frequently so that overgrazing will be prevented. The woodland needs thinning and replanting with white or Virginia pine. (Capability unit IVe–3, woodland suitability group 4, community development group 5)

Brecknock soils, very channery subsoil variant, 8 to 15 percent slopes (BtC).—These soils have a surface layer of friable, dark grayish-brown channery silt loam about 6 inches thick. Their subsoil is dark grayish-brown or olive-brown channery silt loam or channery silty clay loam 15 to 20 inches thick. The substratum is similar to the one in the profile described as typical for the series. About 50 percent of the surface layer is fragments of rock, and the content of these fragments increases with increasing depth. About 90 percent of the lower part of the subsoil is fragments of rock.

These soils are on hills and ridges in the northern third of the county. In places they occur near Penn, Reaville, and Neshaminy soils. Where they occur near the Penn and Reaville soils, their color ranges to dark reddish gray. Near the place where they adjoin the Neshaminy soils, their color is olive gray.

Included with these soils in mapping are small pockets of Lehigh soils. Bedrock crops out on some slopes, and there are occasional springs and seeps.

These Brecknock soils are moderately permeable and have low available moisture capacity. Surface drainage is rapid, and the hazard of erosion is moderate to severe. Natural fertility is low.

These soils are used for the commonly grown field crops and for hay and pasture. A large acreage is idle and is overgrown with weeds, brush, young trees, and cedars. These soils are poorly suited to corn, small grains, and alfalfa, but they are suited to perennial hay or pasture consisting of reed canarygrass, birdsfoot trefoil, tall fescue, and other grasses and legumes that resist drought. The areas in hay and pasture should be reseeded, as required, in alternate field strips or contour strips. Rotation grazing encourages good yields of the better quality forage plants. Moderate, frequent applications of fertilizer and lime are required.

The limited depth and strong slopes are limitations to use of these soils for residential developments. They also restrict use as fields for disposing of the effluent from septic tanks. Suitability for these uses must be decided by determining the depth to bedrock and by properly conducting percolation tests at the specific site. (Capability unit IVe–3, woodland suitability group 4, community development group 4)

Brecknock soils, very channery subsoil variant, 15 to 25 percent slopes (BtD).—These soils have a surface layer of dark grayish-brown or dark olive-gray channery or very channery silt loam that is 6 inches or less thick. Their subsoil is dark grayish-brown or olive-brown very channery silt loam 10 to 18 inches thick. The substratum consists of fractured pieces of bedrock coated with silt

217-083—67——7

loam. Bedrock is generally at a depth of 2 to 3 feet, but it crops out on the surface in a few places. These soils are in the northern part of the county.

Included with these soils in mapping are small streaks of Klinesville soils that are redder than these soils. Near the base of the slopes, occasional springs or seeps have developed. In those areas small patches of moderately steep Lehigh soils are mapped with these soils. In some places soils are included that are so shallow that tillage is in the shattered rock of the substratum. A few scattered areas of Brecknock channery silt loam, 15 to 25 percent slopes, moderately eroded, are also included.

Permeability is moderate, and the available moisture capacity is low. Surface drainage is very rapid, and there is a severe hazard of erosion. Natural fertility is low.

These soils are used, to some extent, for corn, small grains, hay, and pasture. Most of the acreage is idle and is overgrown with sumac, poison-ivy, cedar trees, and weeds. The soils are suitable for pasture and trees, but they are very poorly suited to field crops and hay. Birdsfoot trefoil and reed canarygrass are fairly suitable for pasture, and white pine and Virginia pine are suitable for replanting areas of woodland. New pasture plantings should be made or the areas should be renovated in alternate contour strips. Half of the strips ought to be planted the first year, and the rest the following year. The pastures need to be rotated frequently to prevent overgrazing and loss of the protective cover of plants. Moderate, frequent applications of fertilizer and lime, applied as a topdressing, are required. (Capability unit VIe–1, woodland suitability group 4, community development group 5)

Brecknock very stony silt loam, 8 to 25 percent slopes (BvD).—This soil is on hills and ridges in the northern part of the county. It has a thin layer of partly rotted leaves, twigs, moss, and roots on the surface. Beneath this thin layer is a layer of very dark gray channery silt loam, about 3 inches thick, over about 7 inches of very dark grayish-brown very stony silt loam. The subsoil and substratum are the same as those in the profile described for the series. The stones on the surface and throughout the profile are thick, flat pieces of metamorphosed shale or hornfels 12 to 30 inches across. Included with this soil in mapping are small areas of Lehigh soils.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface drainage is medium to rapid, and there is a slight to moderate hazard of erosion.

This soil is mostly in woodland consisting of mixed oaks, hickory, sweet birch, beech, and red maple. A few areas have been cleared and cultivated, and a few small areas are in pasture. Some of the areas that were formerly cleared and farmed are now overgrown with young trees, weeds, honeysuckle, and poison-ivy. This soil is suitable for trees. Brush and undesirable species of trees should be removed, and open areas or areas that have only a thin stand of trees ought to be planted to white or Virginia pine.

If this soil is cleared and enough stones are removed to permit the use of machinery, it can be used for pasture. Suitable legumes and grasses are ladino clover, birdsfoot trefoil, reed canarygrass, and smooth bromegrass. The pastures need protection from overgrazing. (Capability unit VIs–2, woodland suitability group 4, community development group 5)

Chalfont Series

In the Chalfont series are deep, somewhat poorly drained, nearly level and gently sloping soils that are very silty throughout. These soils are dark yellowish brown mottled with gray. A thick, very slowly permeable layer in the subsoil impedes the downward movement of water and restricts the growth of roots.

These soils are on flats, in depressions, and on the gentle lower slopes in the central part of the county. They are adjacent to the moderately well drained Lawrenceville (fig. 17) and poorly drained Doylestown soils.

In a typical profile of a Chalfont soil, the surface layer is very friable, dark grayish-brown silt loam about 10 inches thick.

The subsoil is dark yellowish-brown silt loam with many, prominent, gray mottles. It is friable just beneath the surface layer, but it is very firm at a depth of about 14 inches. If the part of the subsoil between a depth of 14 and 48 inches is disturbed, the soil material breaks to large blocks that have a gray surface color and are 8 to 10 inches in diameter. The blocks readily break to thin, firm and brittle plates. In places, below a depth of 48 inches, there are many pieces of shale. Depth to bedrock is about 6 feet, but it ranges from 4 to 8 feet.

These soils are slowly permeable and have high available moisture capacity. Plants cannot use all of the moisture, however, because the growth of roots is restricted in the subsoil. The soils are strongly acid to slightly acid.

These soils are suited to hay and pasture. They have severe limitations for use as developments.

Chalfont silt loam, 0 to 3 percent slopes (CfA).—This soil is in depressions, on the lower flats, and on broad uplands in the central part of the county. The areas extend from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties. The profile of this soil is the one described as typical for the series.

In some places in drainageways, the surface layer of this soil is dark grayish-brown silt loam as much as 18 inches thick. In places where the soil is eroded and part of the subsoil has been mixed with the surface layer by tillage, yellowish-brown and gray colors appear in the surface layer. Narrow, gently sloping areas occur adjacent to the drainageways. In a few areas, the reddish-brown shaly substratum is only 24 to 36 inches beneath the surface.

This soil is slowly permeable, and the water table is at the surface or near the surface late in fall, in winter, and early in spring. Surface drainage is slow to medium, and there is a slight to moderate hazard of erosion. This soil has high moisture-holding capacity, but the restricted growth of roots prevents the plants from using all of the moisture available.

This soil is used for general farm crops and for hay and pasture. It is better suited to perennial hay crops and to pastures of grasses and legumes that tolerate wetness than to other uses. Birdsfoot trefoil and reed canarygrass are suitable for both hay and pasture. The

Figure 17.—Area of dark-colored, somewhat poorly drained Chalfont silt loam in depressions near Jeffersonville. The light-colored areas are moderately well drained Lawrenceville soils.

soil is poorly suited to alfalfa and small grains grown in winter. It is fair for cultivated crops that can be planted in spring after the level of the water table falls. If cultivated crops are grown, a suggested cropping system consists of 1 year of a row crop, 1 year of a small grain planted in spring, and at least 3 years of grass-legume hay of adapted varieties. Planting should be done in graded rows, or graded stripcropping used on the longer slopes.

Limitations are severe to use of this soil for residential, light industrial, commercial, or institutional developments. The main limitations are a seasonal high water table, slow permeability, susceptibility to erosion, and lack of stability in the soil material. (Capability unit IIIw–2, woodland suitability group 7, community development group 11)

Chalfont silt loam, 3 to 8 percent slopes, moderately eroded (CfB2).—This soil has a thinner surface layer than the one in the profile described as typical for the series. Gray mottling begins at a depth of 12 to 15 inches, and the firm, slowly permeable part of the subsoil is at a depth of 16 to 24 inches. This soil is on broad, gently undulating uplands adjacent to drainageways in the central part of the county. The areas extend from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties. In some places the shaly substratum is only about 24 inches beneath the surface.

Included with this soil in mapping are nearly level areas and areas in depressions or drainageways where the surface layer is thicker than normal for this soil. Also included are small, severely eroded areas in which the plow layer is brown and is streaked with yellowish brown and gray.

This Chalfont soil is moderately to slowly permeable to a depth of 18 to 24 inches, and it is slowly permeable below that depth. The water table is within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is medium. The hazard of erosion is moderate in many places, but it is severe on the long slopes. The available moisture capacity is high, but plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

This soil is used for the commonly grown row crops, small grains, hay, and pasture. Wetness makes it unsuitable for alfalfa and for small grains grown in winter. The soil is fair for cultivated crops, such as corn and soybeans, and fair to poor for small grains sown in spring. It is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, ladino clover, timothy, and bluegrass. Graded stripcropping is needed where cultivated crops are to be grown. Where graded stripcropping is practiced, a suitable cropping system consists of 1 year of a row crop followed by a cover crop, 1 year of a small grain planted in spring, and at least 3 years of grass-legume hay of adapted varieties.

This soil has severe limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–3, woodland suitability group 7, community development group 11)

Chester Series

The Chester series consists of deep, well-drained, dark yellowish-brown silt loams formed in material weathered from schist and gneiss. These soils are nearly level or gently sloping and are on broad, gently undulating uplands in the southern part of the county.

The Chester soils are adjacent to the moderately well drained Glenville soils and moderately deep to deep, well drained Glenelg soils. Near them on the steeper slopes of hills and ridges are the Manor soils, which are well drained and moderately deep or deep over bedrock.

In a typical profile of a Chester soil, the surface layer is very friable, dark-brown silt loam about 8 inches thick.

The subsoil is dark yellowish-brown silt loam or silty clay loam about 30 inches thick. It is slightly firm in place, but it readily breaks to small, rounded blocks if the soil is disturbed.

The substratum is generally thick and consists of dark-brown or dark grayish-brown sandy loam or silt loam. In places it has a slippery feel when rubbed between the fingers, and it contains many small pieces of schist or gneiss. Typically, bedrock is at a depth of about 6 feet. In some areas, however, the substratum is only about 1 foot thick and bedrock is within 5 feet of the surface. In other areas the substratum consists of deeply weathered bedrock 9 feet or more thick.

These soils are strongly acid or medium acid. They are moderately permeable and have high available moisture capacity and moderate natural fertility.

The soils are well suited to all the crops commonly grown in the county. They have few limitations to use for residential developments.

Chester silt loam, 0 to 3 percent slopes, moderately eroded (CgA2).—This soil is less sloping than the soil for which a profile is described as typical for the series, and its surface layer is about 10 inches thick. It is on broad, flat uplands in the southern part of the county. The areas are not large, nor are they extensive.

Included with this soil in mapping are small areas that are in slight depressions and that have a dark-brown surface layer as much as 15 inches thick. The thick surface layer is the result of deposition of material that was eroded from surrounding soils. In those areas the soil is free of coarse fragments and bedrock is below a

depth of 5 feet. Also included are a few broad areas in which the soil is as shallow as 30 inches over the underlying material.

This Chester soil is moderately permeable and has high available moisture capacity. The hazard of erosion is moderate to slight.

This soil is well suited to a number of different field crops, vegetables, small fruits, hay, and pasture. Crops grown extensively are corn, wheat, barley, and alfalfa (fig. 18). The crops respond well to moderate applications of lime and fertilizer. Contour cultivation ought to be practiced where the slopes are stronger than 2 percent. With contour cultivation, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of grass-legume hay. If 2 years of row crops are desired, field stripcropping is desirable and a cover crop is needed to protect the soil throughout the winter.

This soil has few limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Chester silt loam, 3 to 8 percent slopes, moderately eroded (CgB2).—This soil is on undulating uplands and on gently sloping ridgetops in the southern part of the county. Its profile is the one described as typical for the series. In some places, however, the surface layer is lighter colored than the one in the profile described, or it contains yellowish-brown patches where part of the subsoil has been mixed with the surface soil. Some areas have a thicker surface layer than that in the profile described.

Included with this soil in mapping are small areas in which the soil is only about 30 inches deep over the underlying material. In those areas the soil is free of coarse fragments and bedrock is below a depth of 5 feet.

This soil is moderately permeable and has high available moisture capacity. The hazard of erosion is moderate to severe.

This soil is well suited to small grains and a number of other field crops, and to vegetables, fruit, hay, and pasture. Crops grown extensively are corn, wheat, barley, and alfalfa. The crops respond well to moderate or large applications of lime and fertilizer. Field or contour stripcropping is needed to reduce losses from erosion and to conserve moisture. A cropping system consisting of 2 years of row crops, 1 year of a small grain, and 2 years of hay helps to maintain good tilth, conserve moisture, and reduce erosion. A cover crop is needed to provide protection in winter, and crop residue ought to be returned to the soil.

This soil has few limitations to use for residential, light industrial, commercial, or institutional developments. Precautions are needed, however, because of the hazard of erosion. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Figure 18.—A field of Chester silt loam, 0 to 3 percent slopes, moderately eroded, that has recently been planted to corn. A housing development is encroaching in the background.

Codorus Series

In the Codorus series are deep, moderately well drained or somewhat poorly drained, nearly level silt loams on flood plains in the southern part of the county. These soils formed in soil material washed from uplands underlain by schist, gneiss, limestone, and quartzite.

These soils occur on flood plains with the poorly drained Hatboro soils. On adjacent uplands are the well-drained Glenelg and Manor soils.

In a typical profile of a Codorus soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. The surface layer rests directly on the substratum.

The substratum is brown or yellowish-brown silt loam. It contains flakes of mica that glisten in the sunlight and impart a greasy feel to the soil. Light brownish-gray and strong-brown mottles are common between a depth of 15 and 20 inches. Between a depth of 30 and 54 inches, the substratum is light yellowish-brown loam and contains a few pebbles and many mica flakes. The soil material below a depth of 54 inches consists of stratified sand, silt, and gravel. In many places the substratum contains layers of gray soil material. Depth to bedrock ranges from 3 to 6 feet.

Codorus soils that formed in material eroded from uplands underlain by granite gneiss and quartzite are more sandy than those formed in material eroded from uplands underlain by schist or limestone.

These soils are medium acid. They are moderately permeable and have a high water table late in fall, in winter, and early in spring. These soils are subject to flooding during winter and early in spring. They are also flooded occasionally during the growing season.

These soils are suited to hay and pasture, and they are also suited to corn and small grains sown in spring. The size, shape, and location of the field is likely to determine the use of the soils. Susceptibility to flooding is a limitation to use of these soils for residential, light industrial, commercial, or institutional developments. The soils have value for recreational areas or for open spaces.

Codorus silt loam (Ch).—This is the only Codorus soil mapped in the county, and its profile is the one described as typical for the series. This soil is in narrow strips along most of the streams in the southern part of the county. In a few small areas, it is free of gray mottling to a depth of more than 36 inches.

Included with this soil in mapping are areas of Hatboro soils. These areas are too small to be mapped separately.

This Codorus soil is subject to flooding in winter, early in spring, and sometimes in summer after a storm of high intensity. The water table is at or near the surface late in fall, in winter, and early in spring, but it rarely rises to within 30 inches of the surface during the growing season. The available moisture capacity is high. The hazard of erosion is slight because of the gentle slopes.

This soil is suited to grass and is used mainly for pasture and for sod in golf courses, parks, and estates. It is also suitable for corn, soybeans, and small grains grown in spring, where the size, shape, and location of the fields do not limit use. Occasional flooding is a hazard during the growing season, but tile drains and open drains help to remove the excess water.

The seasonal high water table and the hazard of flooding are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Croton Series

Deep, poorly drained, nearly level or gently sloping soils formed on shale and sandstone make up the Croton series. These soils are on broad uplands, on low-lying flats, in depressions, and on the concave lower slopes. Their subsoil is thick and slowly permeable, and it impedes the downward movement of water and the growth of roots.

These soils are redder than the soils of the Doylestown series. They occur throughout the northern two-thirds of the county, adjacent to the somewhat poorly drained Abbottstown, moderately well drained Readington, and shallow, moderately well drained or somewhat poorly drained Reaville soils. On the nearby uplands are the well-drained, reddish-brown Penn and the brown or yellowish-brown Lansdale soils.

In a typical profile of a Croton soil, the surface layer is friable, weak-red silt loam about 9 inches thick. Beneath the surface layer, the soil material to a depth of 12 to 14 inches is friable silt loam mottled with reddish yellow and reddish gray.

The subsoil is dark reddish-gray to weak-red silty clay loam, 2 to 3 feet thick, that is mottled with yellowish red and light gray. It is firm in place. If the soil is disturbed, however, the material in the subsoil breaks to large columns that have thick gray coatings. These large columns, called prisms, readily break, in turn, to many smaller blocks. The subsoil becomes redder and more shaly with increasing depth. It is reddest just above the dusky-red, highly weathered shale bedrock. Depth to bedrock is about 4 feet, but it ranges from 3 to 5 feet.

These soils are slowly permeable and have high available moisture capacity. They are very strongly acid to moderately acid and have moderate natural fertility.

The Croton soils are suited to perennial hay and pasture. They have severe limitations if used for developments.

Croton silt loam, 0 to 3 percent slopes (CrA).—The profile of this soil is the one described as typical for the series. This soil is in low-lying areas and on broad upland flats, in depressions, and in drainageways. It is widely scattered in small and large areas throughout the northern two-thirds of the county. On some flats at the higher elevations, this soil is more shaly throughout and has a thinner surface layer than the one described as typical for the series. In those areas the surface layer is generally 8 to 10 inches thick. In the central part of the county, the soil material in the upper 24 to 30 inches is very silty and is predominantly gray. In depressions and drainageways, the surface layer is as much as 18 inches thick.

This soil is slowly permeable and has a high water table. The water table is at the surface late in fall, in winter, and early in spring. Surface runoff is slow, and water sometimes accumulates in low pockets. The soil is slow to dry out in spring and during the growing season, and it is wet for several days after a period of heavy rainfall. The hazard of erosion is slight, except on long upland slopes of 2 to 3 percent. The available moisture capacity is high. As a rule, however, plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

This soil is suited to perennial hay and to pasture consisting of shallow-rooted grasses and legumes that tolerate wetness. It is used mainly for pasture, but some areas are used for general field crops. In areas adjacent to cities, much of this soil is in grass on golf courses and in areas surrounding industries and institutions. Large tracts near communities are overgrown with weeds and brush.

Open drains help to remove the surface water. Diversion terraces on the slopes above areas of this soil may reduce wetness caused by seeps and springs. Cultivated crops that require only a short season to mature should be planted in graded rows. On uplands, graded contour strips help to reduce the danger of erosion on the long slopes.

This soil has severe limitations to use for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–1, woodland suitability group 9, community development group 11)

Croton silt loam, 3 to 8 percent slopes, moderately eroded (CrB2).—This soil has a thinner surface layer than the one in the profile described as typical for the series. The surface layer is generally between 6 and 10 inches thick and is underlain by a subsoil of reddish silty clay loam mottled with gray. In some places, however, there are small uneroded or only slightly eroded areas where the surface layer is thicker. This soil is on undulating uplands and on gentle side slopes.

Near Lansdale and Norristown, this soil is very silty and contains only a few pieces of stone above a depth of 24 to 36 inches. South of Norristown and near Hatboro and Ambler, the profile contains more sand than is in the profile described as typical for the series and gray and yellowish-brown colors are predominant. At a higher elevation in the northern part of the county, this soil contains many pieces of shale, and bedrock is at a depth of only about 3 feet. In that vicinity some areas of this soil are dark gray or olive gray mottled with light gray.

This soil is slowly permeable and has a high water table (fig. 19). The water table is at a depth of only 6 inches, or water is ponded on the surface during winter and early in spring. The soil is slow to dry out in spring.

Figure 19.—Area of poorly drained Croton silt loam in a drainageway through areas of Penn, Klinesville, and Reaville soils. The vegetation is cattails.

During the growing season, some spots are wet for several days after a period of heavy rainfall. Some springs and seeps persist throughout the growing season. Surface drainage is generally medium, but it is slow in some pockets. The hazard of erosion is moderate in most places. It is severe in some parts of the uplands where the slopes are long and are between 6 and 8 percent. The available moisture capacity is high. As a rule, however, plants cannot use all of the available moisture, because of the restricted growth of their roots in the subsoil.

On most farms the same cropping system is used for this soil as is used for the other soils in a field. Some areas are kept in hay or pasture.

In suburban areas many fields where this soil occurs are idle. Other areas are in permanent grass in golf courses and in areas adjacent to residential, industrial, or institutional developments. This soil is suited to pasture and perennial hay, and it is well suited to birdsfoot trefoil and reed canarygrass grown for pasture or hay. This soil is fair to poor for corn, soybeans, small grains sown in spring, and vegetables. Wetness makes it poorly suited to alfalfa and winter small grains. If cultivated crops are grown, they should be planted in graded strips, mainly to help in reseeding areas of hay or pasture. Diversion terraces that lead to a grassed waterway help to remove excess surface water and may be helpful in intercepting the water from seeps or springs.

This soil has severe limitations if used for residential, light industrial, commercial, or institutional developments. It also has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IVw–2, woodland suitability group 9, community development group 11)

Croton very stony silt loam, 0 to 8 percent slopes (CsB).—This soil is more grayish than the one for which a profile is described as typical for the series. Also, it has many rounded stones and boulders, as much as 4 feet in diameter, on the surface and throughout the profile. This soil is on flats and in depressions in small areas of irregular shape in the northern third of the county. The total acreage is small.

Permeability is slow, and this soil has a high water table late in fall, in winter, and early in spring. Surface drainage is also slow, and water often accumulates on the surface. The hazard of erosion is slight. The supply of moisture held available for plants is moderate to low.

This soil is mainly in pasture or trees. It is suitable for woodland or wildlife habitats, but the larger, less stony areas can be used for pasture of native grasses. Limitations are severe for residential developments. (Capability unit VIIs–3, woodland suitability group 9, community development group 11)

Doylestown Series

The Doylestown series consists of deep, poorly drained, gray soils that are nearly level or gently sloping and are silty. These soils formed in windblown silt on low-lying flats, in depressions, and on smooth, broad uplands in the central part of the county. They have a thick, slowly permeable subsoil that impedes the downward movement of water and the growth of roots.

The Doylestown soils are adjacent to silty Chalfont soils (fig. 20). On the surrounding uplands are the Lawrenceville soils.

In a typical Doylestown soil, the surface layer is friable, very dark grayish-brown silt loam 8 to 10 inches thick.

The subsoil is mainly gray silt loam about 36 inches thick, but it contains patches and streaks of yellowish brown and strong brown. If the soil is disturbed, the subsoil breaks to large columns 6 to 8 inches in diameter, and these columns, in turn, back readily to smaller blocks and flat plates. The upper part of the subsoil is friable, but the soil material is very firm below a depth of about 18 inches. Depth to bedrock ranges from 4 to 8 feet.

Permeability is slow, and the soils have high available moisture capacity. They are moderately acid to slightly acid and have moderate to low natural fertility.

These soils are suited to perennial hay and pasture. They have severe limitations for residential developments.

Doylestown silt loam, 0 to 3 percent slopes (DsA).—This soil is in depressions and on low-lying flats. It occurs in the central part of the county, especially near Lansdale. The profile is the one described as typical for the series. In some places, however, the surface layer contains streaks or patches of gray and yellowish brown.

This soil is slowly permeable and has a high water table near the surface late in fall, in winter, and in spring. Surface drainage is slow, and at times, water accumulates on the surface. The hazard of erosion is slight. The available moisture capacity is high. As a rule, however, plants cannot use all the moisture available, because of the restricted growth of their roots in the subsoil.

This soil is used for general field crops, hay, and pasture. Much of the acreage is idle and is overgrown with grass, brush, and trees. The soil is suited to pasture and perennial hay, and reed canarygrass and birdsfoot trefoil are well suited to those purposes. The soil has severe limitations if it is used for cultivated crops that require

Figure 20.—**A typical landscape showing a Doylestown soil near areas of Chalfont and Lawrenceville soils. The Doylestown soil is in the foreground, the Chalfont soil is in the shallow depressions in the center, and the Lawrenceville soil is on the uplands in the background.**

a long time to mature and if it is used for small grains grown in winter. Corn for silage, and other row crops that require only a short growing season, can be grown if surface drainage is improved by planting the crop in graded rows and providing open drains. Yields, however, are likely to be low.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–1, woodland suitability group 9, community development group 11)

Doylestown silt loam, 3 to 8 percent slopes, moderately eroded (DsB2).—This soil has a grayish-brown or dark-gray surface layer that is 6 to 8 inches thick. The surface layer has patches and streaks of yellowish brown and gray in many places. The soil is in small areas scattered throughout undulating uplands and in bands near the foot of long, gentle slopes.

In small areas in depressions and drainageways, this soil has a surface layer like the one in the profile described as typical for the series. Where this soil adjoins areas of Chalfont soils, the upper part of the subsoil is brown and is prominently mottled with gray.

This soil is slowly permeable and has a high water table at or near the surface late in fall, in winter, and early in spring. Surface drainage is medium to slow, and the hazard of erosion is moderate to slight. The available moisture capacity is high. As a rule, however, plants cannot reach all the moisture available, because of the restricted growth of their roots in the subsoil.

This soil is used for general field crops, hay, and pasture, but part of the acreage is idle. The soil is suited to hay and pasture, and it is poor to fair for cultivated crops that require only a short season to mature. It is well suited to reed canarygrass and birdsfoot trefoil, fair to poor for corn grown for silage, and poor for alfalfa and winter small grains. Perennial hay or pasture should be seeded in graded contour strips.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IVw–2, woodland suitability group 9, community development group 11)

Duffield Series

In the Duffield series are deep, well-drained, gently sloping to moderately steep soils formed on limestone. These soils are on undulating uplands in the south-central part of the county. They form a narrow belt that extends from Valley Forge State Park through the town of Plymouth Meeting to just west of Willow Grove.

The Duffield soils are adjacent to the low-lying, very silty Lawrenceville soils. They occur with well-drained Lansdale, Penn, Edgemont, Manor, and Glenelg soils, which are on nearby hills and ridges.

In a typical profile of a Duffield soil, the surface layer is very friable, dark grayish-brown silt loam. It is about 6 inches thick.

The subsoil is mainly friable, strong-brown to yellowish-red silty clay loam, but the extreme upper and lower parts have a texture of silt loam. The subsoil is about 5 feet thick. When soil material from the subsoil is removed, it readily breaks to many small blocks that have smooth, flat surfaces. These blocks can be handled without breaking, but they can be crushed between the thumb and forefinger.

The substratum is strong-brown silt loam about 5 feet thick. Dark-gray limestone bedrock is generally at a depth of about 10 feet, but the depth ranges from 4 to 12 feet.

The Duffield soils are moderately permeable and have high available moisture capacity. They are strongly acid to slightly acid and have high natural fertility.

These soils are well suited to all the crops commonly grown in the county. They have few limitations if used for developments.

Duffield silt loam, 3 to 8 percent slopes, moderately eroded (DuB2).—This soil is on broad, undulating uplands in the limestone valley in the south-central part of the

county. It occupies moderately large areas in a belt about 2 miles wide that extends from Valley Forge State Park to Willow Grove. Its profile is the one described as typical for the series.

Included with this soil in mapping are small areas in which the slopes are less than 3 percent. In slight depressions and on the lower slopes, the surface layer is thicker than typical because a small amount of soil material has been deposited on it. In some places there are lighter colored patches where plowing has mixed part of the subsoil into the surface layer. Near Conshohocken and along the southern edge of the limestone valley, this soil is shallower over bedrock and contains more mica than typical. As much as 35 percent of it consists of fragments of rock. In a few small areas, the subsoil is red silty clay or silty clay loam. On the lower part of gentle slopes, the soil material in the uppermost 1 to 2 feet of the subsoil is yellowish-brown silt loam in which there is a high proportion of silt.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is used for general field crops, nursery stock, hay, and pasture. Also, a large acreage is in sod and is used for golf courses. This soil is well suited to corn, vegetables, nursery stock, small grains, and alfalfa. Growing crops in field or contour strips and using a cropping system consisting of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay will conserve moisture, reduce losses from erosion, and help to maintain good tilth. A cover crop ought to be planted with the row crop to provide protection in winter, and crop residue ought to be returned to the soil.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. Possible solution channels and sinkholes or caves in the limestone bedrock, however, make careful investigation of the site necessary before roads are constructed or large or heavy structures are built. This soil is unstable and is subject to severe erosion if it is disturbed. If it is used as a disposal field for the effluent from septic tanks, solution channels in the bedrock may allow contamination of the ground water. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Duffield silt loam, 8 to 15 percent slopes, moderately eroded (DuC2).—This soil is steeper than the one for which a profile is described as typical for the series, and it has a subsoil that is only 2 to 4 feet thick in most places. It is in the undulating uplands of the limestone valley. This valley extends in a band about 2 miles wide from Valley Forge State Park to a point near Willow Grove. Along the southern edge of the valley, this soil is shallower over bedrock than in other areas and it contains more mica and more channers. In some places on toe slopes, the surface layer is 10 to 15 inches thick.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

Most of the acreage is in grass sod in parks or golf courses, or in areas surrounding institutions, estates, and industries. Part of the acreage is idle, and the rest of it that is farmed is used for commonly grown field crops, nursery stock, fruit, hay, and pasture. This soil is well suited to corn, vegetables, small grains, and alfalfa. Moisture can be conserved and losses from erosion reduced by farming in contour strips and using a suitable cropping system. Such a cropping system may consist of 1 year of a row crop, 1 year of a small grain, and 2 or more years of hay. The crop residue should be returned to the soil.

This soil has few limitations for residential developments. If it is used intensively as a disposal field for the effluent from septic tanks, however, the ground water may become contaminated. Contamination may take place because the effluent is not filtered properly and moves rapidly through the solution channels in the bedrock. Where this soil is disturbed, it is unstable and is subject to severe erosion. (Capability unit IIIe–1, woodland suitability group 2, community development group 2)

Duffield silt loam, 8 to 15 percent slopes, severely eroded (DuC3).—This soil has a surface layer of brown silt loam or silty clay loam 5 to 6 inches thick. The subsoil is like the one in the profile described as typical for the series, except that it is only 1½ to 3 feet thick. In most places the substratum is between 2 and 4 feet thick and bedrock is at a depth of 4 to 6 feet. This soil is on undulating uplands of the narrow limestone valley that extends from Valley Forge State Park to a point near Willow Grove. The slopes are short.

In some places where erosion has been active or this soil is near gullies, there are patches where the surface layer is strong brown. In a few places, bedrock crops out on the surface.

Included with this soil in mapping are areas of soils that are more channery throughout than this soil. Also included are areas of soils that have a micaceous substratum.

Permeability is moderate, and this soil has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

Most of the acreage is idle or is in industrial and residential developments. Part of it is in sod in parks and golf courses. A small acreage is used for general farm crops and pasture. This soil is fair for corn, winter small grains, and fruit. It is better suited, however, to perennial hay and pasture. If this soil is cultivated, the crops ought to be planted in contour strips and a cropping system used that consists of 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of deep-rooted grasses and legumes grown for hay. The crop residue ought to be returned to the soil, and diversion terraces may be needed on the long slopes.

Where this soil is used for residential developments, it needs a protective cover of grass, shrubs, or trees. The strong slope is a limitation if the soil is used for residential developments. This soil erodes easily if it is disturbed. Solution channels in the bedrock may allow contamination of the ground water if this soil is used intensively as a disposal field for the effluent from septic tanks. (Capability unit IVe–1, woodland suitability group 2, community development group 2)

Edgemont Series

In the Edgemont series are moderately deep to deep, well-drained channery loams that are gently sloping to steep. These soils formed in material weathered from

quartzite and quartz schist. They are on hills and ridges in the south-central part of the county and are widely scattered along a line that extends from Valley Forge State Park to just west of Bryn Athyn.

These soils occur on uplands, mainly with the Glenelg and Manor soils, and they are adjacent to the Lawrenceville, Chalfont, and Doylestown soils of association 10. The Edgemont soils are coarser textured than the Glenelg soils. They are less red than the Penn soils, finer textured than the Lansdale soils, and deeper and less micaceous than the Manor soils. The Edgemont soils are at a higher elevation than the Duffield soils, which are adjacent, and they are coarser textured and more channery than those soils.

In a typical profile of an Edgemont soil, the surface layer is very friable, dark grayish-brown channery loam about 8 inches thick. Between 20 and 35 percent of the surface layer consists of flat pieces of rock.

The subsoil is yellowish-brown to brown channery loam about 3 feet thick. From 10 to 30 percent of the subsoil consists of flat pieces of rock.

The substratum is brown very channery sandy loam that is about 1 foot thick. From 40 to 80 percent of it is flat pieces of rock. Gray to brown quartz schist and quartzite bedrock are generally at a depth of about 5 feet, but the depth ranges from 3 to 5 feet.

Permeability is moderately rapid, and the amount of moisture held available for plants is moderate to high, depending on the depth to bedrock. These soils are very strongly acid or strongly acid and have low to moderate natural fertility. A moderate to large amount of lime and fertilizer, in frequent applications, is needed.

These soils are well suited to a number of different field crops and to fruit, hay, and pasture. The high content of stones and the steep slopes are the principal limitations to use for developments.

Edgemont channery loam, 3 to 8 percent slopes, moderately eroded (EcB2).—The profile of this soil is the one described as typical for the series. This soil is on undulating hilltops and ridges in the south-central part of the county. Included with it in mapping are a few narrow flats where the gradient of the slopes is less than 3 percent.

Where this soil is in slight depressions and on the lower toe slopes, its surface layer is 10 to 15 inches thick. In some wooded areas, the surface foot of soil material consists of a layer of leaves and of leaf mold, about 2 inches thick, over about 4 inches of very dark gray channery sandy loam. Beneath the channery sandy loam is about 6 inches of grayish-brown channery loam.

Near Fort Washington State Park, the profile of this soil is more silty than the one described as typical for the series and the color of the subsoil is reddish brown in some places. Also, bedrock is at a depth of only 2 feet on some of the narrow ridgetops.

Included with this soil in mapping are areas in which the soil material above the substratum consists of about 2 feet of silt loam that contains a few fragments of rock. The substratum in those areas is like the one in the profile described as typical for the series.

This soil has moderately rapid permeability and moderate to high available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is mainly in parks and golf courses, or in areas that surround estates, institutions, or residential developments. Only a small acreage is farmed. This soil is fairly well suited to most field crops and to hay and pasture. If cultivated crops are grown, however, they should be planted in field or contour strips. A suitable cropping system, where the crops are planted in strips, consists of 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and 2 years of grass-legume hay.

Bedrock near the surface is a moderate limitation to use of this soil for residential, light industrial, commercial, or institutional developments. It is also a limitation to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IIe–2, woodland suitability group 3, community development group 1)

Edgemont channery loam, 8 to 15 percent slopes, moderately eroded (EcC2).—This soil is steeper and shallower over bedrock than the one for which a profile is described as typical for the series. The subsoil is only 2 to 2½ feet thick over about ½ to 1 foot of very channery sandy loam. In most places bedrock is at a depth of 3 to 4 feet. This soil is on hills and ridge slopes in the south-central part of the county. It is near areas of Manor and Glenelg soils on the adjacent hilly uplands.

In a few wooded areas, this soil has a layer of leaves and leaf mold on the surface like that described for wooded areas of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded, and the soil material is about the same to a depth of about 1 foot as that in the less sloping Edgemont soil. Near Fort Washington State Park, the profile of this soil is more silty than the one described as typical for the series, and the color of the subsoil ranges to reddish brown. In a few places bedrock is only 2 feet beneath the surface. Included with this soil in mapping are small areas of Penn, Manor, and Glenelg soils.

This Edgemont soil is moderately permeable and has moderate available moisture capacity. Surface runoff is medium to rapid, and there is a moderate hazard of erosion. Crops grown on this soil respond well to large applications of lime and fertilizer.

Most areas of this soil are in golf courses and parks. Part of the acreage is idle, and part of it surrounds estates, institutions, and housing developments. Only a small acreage is farmed. The soil is fairly well suited to corn, winter small grains, alfalfa, and nursery stock. If cultivated crops are grown, however, planting should be done in field or contour strips. A suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay.

Because of its strong slopes, this soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It also has moderate limitations for use as a disposal field for the effluent from septic tanks. If a large amount of effluent is discharged on the steeper slopes, seepage downslope may result. (Capability unit IIIe–2, woodland suitability group 3, community development group 2)

Edgemont channery loam, 15 to 25 percent slopes, moderately eroded (EcD2).—This soil is steeper and shallower than the one for which a profile is described as

217–083—67——8

typical for the series. The surface layer consists of about 6 inches of dark grayish-brown channery loam or channery sandy loam. The subsoil is 18 to 30 inches thick and is underlain by 4 to 12 inches of very channery sandy loam. This soil occupies sparsely scattered areas on hills and ridge slopes in the south-central part of the county. The areas are in a belt that extends from the Valley Forge State Park to Bryn Athyn. On adjacent slopes are the Manor, Glenelg, and Lansdale soils.

A part of the acreage is wooded. In those areas the surface layer is dark colored; the soil material, to a depth of about 1 foot, is like that described for wooded areas of Edgemont channery loam, 3 to 8 percent slopes, moderately eroded.

In areas near Fort Washington, this soil is more silty than typical and small areas of Manor and Glenelg soils are included with it in mapping. Also included are areas where the soil is severely eroded. In those areas the surface layer is very channery loam 4 to 6 inches thick, and bedrock is generally 2½ to 4 feet beneath the surface. Other inclusions consist of small areas of moderately eroded Duffield soils that have slopes of 15 to 25 percent. These Duffield soils are normally adjacent to and lower lying than the Edgemont soils and have received some coarse-textured material from the Edgemont soils. Bedrock crops out in a few places.

This Edgemont soil has moderately rapid permeability and moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

A large part of the acreage is in golf courses and parks or has been landscaped and surrounds estates, institutions, and housing developments. If this soil is farmed, it is suited to perennial hay and pasture. Corn and small grains can be grown in field or contour strips, in a cropping system consisting of 1 year of a row crop, 1 year of a winter small grain, and 4 years of grass-legume hay. The long slopes need to be protected by diversion terraces.

This soil has moderate to severe limitations for residential developments. It has severe limitations for light industrial, commercial, and institutional developments. (Capability unit IVe–2, woodland suitability group 3, community development group 5)

Edgemont very stony loam, 8 to 25 percent slopes (EsD).—The surface layer of this soil consists of 2 to 3 inches of fresh leaves and leaf mold over a layer, 3 to 4 inches thick, of very dark gray or black very stony loam. Below this is about 4 inches of grayish-brown very stony loam. The subsoil and substratum are similar to those in the profile described as typical for the series. Flat pieces of quartzite or quartz schist, 2 to 10 inches thick and 10 to 24 inches across, are scattered throughout the profile. Stones cover about 1 to 5 percent of the surface. This soil is on hills and ridges in the south-central part of the county. The largest areas are in Valley Forge State Park.

Included with this soil in mapping are nearly level and gently sloping areas on narrow ridges and hilltops. Small areas of Manor and Glenelg soils are also included.

This Edgemont soil has moderately rapid permeability and moderate to high available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight.

This soil is mainly in woods and is in parks or adjacent to estates and residential developments. It is suitable for pasture, but it is better suited to trees. In wooded areas the stands consist of different kinds of oak, tulip-poplar, ash, red maple, and dogwood. Undesirable species and brush ought to be removed, and open areas or areas where the stand is thin should be planted to white or Virginia pine.

The strong slopes and stones are moderate to severe limitations to use of this soil for residential developments. Limitations are also severe for light industrial, commercial, and institutional developments. (Capability unit VIs–2, woodland suitability group 3, community development group 5)

Glenelg Series

In the Glenelg series are moderately deep to deep, well-drained silt loams that are gently sloping to moderately steep. These soils formed in material weathered from schist and gneiss. They are on undulating and rolling uplands in the southern part of the county. Adjacent to them are the well-drained Chester soils that are deep over bedrock and the well-drained Manor soils that are moderately deep or deep over bedrock. Also adjacent are the moderately well drained to somewhat poorly drained Glenville soils.

In a typical profile of a Glenelg soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. From 10 to 15 percent of it is thin, flat pieces of rock.

The subsoil is friable, strong-brown fine silt loam about 16 inches thick. About 15 percent of the upper part is thin fragments of rock, but the content of rock increases to about 35 percent in the lower part of the subsoil.

The substratum is friable, brown very channery silt loam about 2 feet thick. From 50 to 90 percent of it is thin fragments of rock. Depth to slightly weathered bedrock is generally about 4 feet, but it ranges from 2½ to 5 feet.

These soils have a moderately permeable subsoil, but permeability is moderately rapid in the substratum. The available moisture capacity is moderate. These soils are very strongly acid to medium acid and have moderate natural fertility. Where crops are grown, medium to large applications of fertilizer and lime are required.

These soils are well suited to a number of kinds of field crops and to hay and pasture. The gentle to moderately steep slopes are the main limitations to their use for residential developments (fig. 21).

Glenelg silt loam, 3 to 8 percent slopes, moderately eroded (GnB2).—This soil is on undulating uplands in the southern third of the county. Generally, it has a subsoil that is 18 to 24 inches thick, and it contains fewer fragments of rock than the soil for which a profile is described as typical for the series. In the eastern part of the county near Bryn Athyn, this soil is more sandy below a depth of 2 feet than the profile described as typical for the series. Near Gulph Mills in the western part, it is more channery throughout.

Included with this soil in mapping are nearly level areas in which the slopes are less than 3 percent; a few areas in which the surface layer is 10 to 12 inches thick; and many areas in which the substratum contains a higher

Figure 21.—**Typical low-density development on Glenelg, Manor, and Glenville soils near Barren Hill. Glenelg soils are in the foreground, Manor soils are in the background, and Glenville soils are in the depression in the center.**

proportion of mica flakes than typical. Also included are a few small areas of Manor, Chester, and Glenville soils.

Permeability is moderate, and this soil has moderate available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate.

Much of the acreage surrounds estates or residential, industrial, and institutional developments, and part of it is in golf courses. Where this soil is farmed, it is used for general field crops, nursery stock, hay, and pasture. This soil is well suited to corn, fruit, nursery stock, small grains, and alfalfa. Planting the crops in field or contour strips helps to conserve moisture, reduces losses from erosion, and maintains good tilth. A suitable cropping system is one that is no more intensive than 2 years of row crops, 1 year of a winter small grain, and 2 years of grass-legume hay. Diversion terraces help to reduce erosion and loss of moisture on the long slopes. A cover crop ought to be planted in the row crop the first year, and all crop residue should be returned to the soil.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. Depth is a limitation to use as a disposal field for the effluent from septic tanks. If a septic tank is planned, it is suggested that percolation tests be made at the specific site to determine the effect of bedrock. (Capability unit IIe–2, woodland suitability group 4, community development group 3)

Glenelg silt loam, 8 to 15 percent slopes, moderately eroded (GnC2).—This soil is on rolling hills and undulating uplands in the southern third of the county. Its profile is the one described as typical for the series. In the eastern part of the county, near Bryn Athyn, however, the profile is more sandy throughout than the one described as typical for the series, and it contains fewer fragments of rock. In the western part of the county, near Gulph Mills, the profile has more fragments of schist throughout than typical. In some places the substratum has a high content of soft, weathered mica.

Included with this soil in mapping are small areas of Chester and Manor soils. Also included are eroded areas in which the surface layer is brown silt loam or channery silt loam about 6 inches thick. After an area is plowed, streaks of strong-brown subsoil material can be seen in the plow layer. A few stony areas are included with this soil. In those areas 1 to 3 percent of the surface layer is covered by stones 1 to 3 feet in diameter.

This Glenelg soil is moderately permeable and has moderate available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Less than a third of the acreage is farmed. The rest is in grass, trees, or shrubs, and in golf courses, parks, estates, and areas surrounding residential developments, industries, or institutions. Part of the acreage has not been maintained and is reverting to native vegetation. This soil is well suited to corn, small grains, fruit, nursery stock, alfalfa, and a number of different grasses and legumes. Losses from erosion can be reduced, moisture conserved, and the tilth maintained or improved by growing the crops in contour strips. A suggested cropping system is 1 year of a row crop, 1 year of a small grain, and at least 2 or 3 years of deep-rooted grasses and legumes grown for hay. A cover crop should be grown where feasible, crop residue ought to be conserved and returned to the soil, and manure should be added along with lime and commercial fertilizer.

This soil has moderate limitations of strong slopes if it is used for commercial, light industrial, institutional, or residential developments. It also varies in depth and thus has limitations for use as a field for disposing of the effluent from septic tanks. Percolation tests are needed and depth to bedrock at the specific site should be determined if this soil is to be used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–2, woodland suitability group 4, community development group 4)

Glenelg silt loam, 15 to 25 percent slopes, moderately eroded (GnD2).—This soil is on low hills and ridges in the southern third of the county. It is shallower over bedrock and is more channery in many places than the soil for which a profile is described as typical for the series. The surface layer is about 6 inches thick, and 10 to 35 percent of it consists of flat pieces of rock. The subsoil is 15 to 24 inches thick. In some places the substratum consists of several inches of broken rock. In other places it is as much as 2 feet thick and consists of channery loam or silt loam.

In a few small areas, the slopes are greater than 25 percent. In a few places, the profile contains a large amount of soft mica flakes and has less than 30 percent coarse fragments throughout. In some places the plow layer is very channery, is 4 to 6 inches thick, and has a brown to yellowish-brown color.

Included with this soil in mapping are small areas of Manor soils. Bedrock crops out on the surface in some places, and stones, 1 to 3 feet in diameter, occupy 1 to 4 percent of the acreage. The stones are mostly in small patches.

This soil is moderately permeable and has moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

Practically all of this soil is covered by grass, trees, shrubs, or weeds. This soil is fair for corn and small grains, but it is better suited to long-term hay or pasture. If cultivated crops are grown, they should be planted in field or contour strips. A cropping system made up of 1

year of a row crop, 1 year of a small grain, and at least 3 or 4 years of grasses and legumes grown for hay is suitable. All the crop residue ought to be conserved and returned to the soil. Diversion terraces and grassed waterways safely dispose of runoff and reduce losses of moisture, and they help to control erosion.

Because of its strong slopes, this soil has severe limitations for residential, light industrial, commercial, or institutional developments. It can be used to a limited extent, however, for individual residences. (Capability unit IVe–2, woodland suitability group 4, community development group 5)

Glenville Series

The Glenville series consists of deep, moderately well drained or somewhat poorly drained silt loams or silty clay loams that are nearly level and gently sloping. These soils formed in material weathered from schist or gneiss. Permeability is moderately slow in the subsoil, and as a result, the downward movement of water is slowed.

The Glenville soils are on upland flats, in depressions, and on the lower slopes in the southern part of the county. They occur on uplands with the deep, well-drained Chester soils and the moderately deep, well-drained Glenelg soils. On flood plains adjacent to them or nearby are the Codorus and Hatboro soils. Also, in nearby areas on the narrow ridgetops and steeper side slopes are the shallow, well-drained Manor soils.

In a typical profile of a Glenville soil, the surface layer is very friable, dark grayish-brown silt loam about 8 inches thick.

The upper part of the subsoil is friable, dark yellowish-brown silt loam with a few brown or yellowish-brown mottles. The lower part of the subsoil is yellowish-brown silt loam or silty clay loam, and it has many grayish mottles at a depth of 15 to 30 inches. The material in the subsoil is fairly firm in place. If it is disturbed, it breaks readily to many small blocks that have smooth surfaces and angular edges. The subsoil is about 36 inches thick. It is underlain by a substratum of friable, dark yellowish-brown or reddish-brown loam. The substratum contains mica that glitters and imparts a slippery feel to the soil material. It is more than 2 feet thick. Depth to bedrock ranges from 4 to 8 feet.

Permeability is moderately rapid in the surface layer, moderately slow in the subsoil, and moderate in the substratum. The available moisture capacity is high. The soils are very strongly acid or strongly acid, and they have moderate natural fertility.

These soils are moderately well suited to most cultivated crops planted late in spring and to small grains planted in spring. They are well suited to hay and pasture.

A seasonal high water table is a limitation to use of the soils for residential developments. It is also a limitation to use for disposal fields for the effluent from septic tanks.

Glenville silt loam, 0 to 3 percent slopes (GsA).—This soil is on low-lying flats, in depressions, and on broad upland summits in the southern third of the county. It occurs in scattered patches adjacent to the lower lying Codorus and Hatboro soils of the flood plains. The surface layer is very dark grayish brown and is 10 to 15 inches thick. In the areas on the broad uplands, it more nearly resembles the surface layer in the profile described as typical for the series than does the surface layer in other areas. The upper part of the subsoil has more gray mottling than indicated in the profile described as typical for the series.

In some areas in depressions and drainageways, where this soil has received overwash from surrounding areas, the surface layer is as thick as 24 inches. In a few small areas, gray mottling is at a depth of 10 to 15 inches. South of Fort Washington and near Bryn Athyn, the lower part of the profile contains more sand than normal for this soil.

Beginning at a depth of 15 to 24 inches, this soil contains a layer in which permeability is moderately slow. Permeability is moderate below a depth of 3 to 4 feet. Surface drainage is slow. Late in fall, in winter, and early in spring the water table is within 1 or 2 feet of the surface. This soil is slow to dry out in spring. Usually, it can be worked early enough so that corn can be planted, but some depressions remain wet well into the growing season. This soil has high available moisture capacity, but the growth of roots is restricted in the firm subsoil. The hazard of erosion is slight.

This soil is used for commonly grown field crops, vegetables, fruit, nursery stock, hay, and pasture. Many other areas are in sod on golf courses or in areas surrounding estates, industries, and institutions. This soil is fair for corn, soybeans, small grains planted in spring, and vegetables planted late in spring. Alfalfa and winter small grains, however, are subject to winterkill. The crops grown in areas that do not have long slopes can be planted in graded rows, using a cropping system consisting of 1 year of a row crop, 1 year of a spring-seeded small grain, and at least 1 year of grass-legume hay. On the long slopes, field or graded stripcropping is needed to reduce erosion. A suitable cropping system, where stripcropping is used, consists of 2 years of row crops, each crop followed by a cover crop in winter, and 1 year of grass-legume hay. Tile drains are effective in reducing wetness caused by springs and seeps.

Limitations to the use of this soil for residential, light industrial, institutional, or commercial developments are the seasonal high water table, slow surface drainage, and slow permeability. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Glenville silt loam, 3 to 8 percent slopes, moderately eroded (GsB2).—This soil is on smooth, gentle upland slopes and on the lower toe slopes and benches. The areas are scattered throughout the southern third of the county. In general, the profile is like the one described as typical for the series. In many places, however, on toe slopes and in depressions, the surface layer is 12 to 18 inches thick. In a few small areas that are wetter than the surrounding areas, gray mottling begins just below the surface layer. South of Fort Washington and near Bryn Athyn, the profile has more sand throughout than the profile described as typical for the series.

Beginning at a depth of 15 to 24 inches, this soil contains a layer in which permeability is moderately slow. Below a depth of 3 to 4 feet, the substratum is moderately permeable. Surface drainage is slow to medium, and

the hazard of erosion is moderate to slight. The water table is within a foot of the surface during winter and early in spring. This soil is slow to dry and warm up in spring, but it can usually be worked in time for planting all but the earliest crops. Some wet pockets, seeps, and springs, however, persist into the growing season. The available moisture capacity is high, but plants cannot use all of the moisture available. This is because the growth of their roots is restricted by the firm subsoil.

Many areas of this soil are in sod and are on golf courses or in areas surrounding estates, institutions, or industries. This soil is fairly well suited to corn, soybeans, vegetables, fruit, and small grains seeded in spring, and part of the acreage is used for those purposes. Yields of winter small grains are likely to be reduced by frost heaving. Also, alfalfa is not so long lived as it is on the adjacent Chester soils. Where crops are grown, field or contour stripcropping should be practiced. Then, a suitable cropping system would be 2 years of row crops, each crop followed by a cover crop, 1 year of a small grain, preferably seeded in spring, and at least 2 or 3 years of grass-legume hay. Random tile drains are effective in reducing wetness in depressions and in seep areas near the foot of slopes.

Lack of good drainage is a limitation to use of this soil for residential, light industrial, institutional, or commercial developments. The seasonal high water table makes the sealing of basements difficult. This soil has severe limitations to use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Hatboro Series

In the Hatboro series are deep, poorly drained silt loams on flood plains in the southern part of the county. These soils formed in soil material washed from uplands underlain by schist, gneiss, limestone, and quartzite. They occur on the same flood plains as the moderately well drained or somewhat poorly drained Codorus soils. Near them, on the adjacent uplands, are the well-drained Chester, Manor, and Glenelg soils.

In a typical profile of a Hatboro soil, the surface layer is dark-brown to dark grayish-brown silt loam. It is about 10 inches thick.

The subsoil is gray silt loam or silty clay loam that is sticky and plastic when wet. It is about 3 feet thick.

The subsoil is underlain by about 1 foot of grayish-brown to light brownish-gray sandy clay loam to sandy loam, which, in turn, is underlain by bedrock. Depth to bedrock ranges from 4 to 8 feet.

These soils are very strongly acid or strongly acid and have moderately slow permeability. Occasionally, the water table is high during the growing season, and it is high late in fall, in winter, and early in spring. The high water table is a limitation to use of these soils for agriculture or developments. The hazard of flooding is also a severe limitation to use of these soils for developments.

Hatboro silt loam (Ha).—This is the only Hatboro soil mapped in the county. Its profile is the one described as typical for the series. This soil is on many of the narrow flood plains in the southern part of the county. It occupies broad, flat areas and is in depressions along the edges of the flood plains at the base of upland slopes. In some places small areas of Codorus silt loam, which is better drained than this soil, are included with it in mapping.

This Hatboro soil is subject to flooding during winter and early in spring. Occasionally, it is flooded during the growing season. The water table is at or above the surface late in fall, in winter, and early in spring. Some areas remain wet all year because they receive extra moisture as the result of hillside seeps or because they have slow surface drainage. The hazard of erosion is slight, and this soil has high available moisture capacity.

This soil is used mainly for pastures or is in sod in parks and estates. Much of the acreage is idle, however, and has a cover of weeds and brush. The soil is well suited to pasture and to birdsfoot trefoil and orchardgrass. It is fairly well suited to poorly suited to corn and soybeans and is poorly suited to small grains and alfalfa. If suitable outlets are available, surface water and the excess water in the soil can be removed by installing open drains and tile drains.

The high water table and hazard of flooding are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. (Capability unit IIIw–1, woodland suitability group 8, community development group 12)

Howell Series

The Howell series consists of deep, well-drained, gently sloping soils formed in stratified sand, silt, clay, and gravel. These soils developed on remnants of coastal plain terraces on uplands and benches. They occur in the extreme south-central part of the county.

The Howell soils are adjacent to moderately well drained or somewhat poorly drained Beltsville soils that are in depressions underlain by similar material. Near the Howell soils, on the adjacent uplands, are Duffield soils underlain by limestone, and Manor and Glenelg soils underlain by schist and gneiss.

In a typical profile of a Howell soil, the surface layer is very friable, dark grayish-brown silt loam. The surface layer contains a few pebbles.

The uppermost 8 inches of the subsoil is yellowish-brown silty clay loam that contains some gravel. Below a depth of 16 inches, the subsoil is strong-brown silty clay loam to a depth of about 32 inches. It is yellowish-red gravelly clay loam between a depth of about 32 and 50 inches.

The substratum is at a depth below 50 inches. It consists of stratified dark-brown silt loam and yellowish-red or red gravelly clay loam and gravelly sandy loam. Depth to bedrock is generally about 8 feet but ranges from 6 to 30 feet.

These soils are strongly acid. They are moderately permeable and have high available moisture capacity. Their natural fertility is moderate to low.

The Howell soils are well suited to a number of kinds of field crops, vegetables, fruits, hay, and pasture. They have few limitations as sites for developments.

Howell silt loam, 3 to 8 percent slopes, moderately eroded (HwB2).—This is the only Howell soil mapped in Montgomery County. Its profile is the one described

as typical for the series. This soil is on uplands and benches in the south-central part of the county. It occurs near the towns of Bridgeport, Conshohocken, and Plymouth Meeting where coastal plain terraces overlie the limestone and schist bedrock in small areas. The acreage of this soil is not extensive, and the individual areas are small and scattered.

Included with this soil in mapping are small areas in which as much as 2 feet of the upper part of the subsoil consists of very silty, yellowish-brown soil material. Also included are small, nearly level areas in which gray mottling is at a depth of 30 or more inches. These mottled areas dry more slowly in spring than do the surrounding areas.

Permeability is moderate, and the available moisture capacity is high. The hazard of erosion is moderate.

This soil is used mainly for field crops, but idle areas are common. The soil is well suited to corn, soybeans, small grains, alfalfa, orchardgrass, and ladino clover, but field or contour stripcropping is needed to reduce losses from erosion. A cropping system that consists of 2 years of row crops with a cover crop, 1 year of a small grain, and 2 years of hay helps to maintain good tilth, conserve moisture, and reduce erosion. Most of this soil will likely be used for residential or industrial developments. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Klinesville Series

In the Klinesville series are well-drained, gently sloping to steep, reddish-brown, shallow soils that are shaly and droughty. These soils formed in material weathered from red shale and siltstone. They are widely distributed throughout the northern half of the county and are on undulating uplands and on hills and steep side slopes adjacent to drainageways. These soils are adjacent to the Penn, Reaville, and Readington soils. They are shallower and more shaly than the Penn soils and lack the gray, mottled horizon that is typical in the profile of the Reaville soils. They are much shallower and more shaly than the typical Readington soils.

In a typical Klinesville profile, the surface layer is reddish-brown very shaly silt loam about 5 inches thick. About half of the surface layer consists of pieces of dusky-red and reddish-brown fragments of shale. In some places these soils lack a distinct subsoil, but where the subsoil is present, it is reddish-brown very shaly silt loam about 10 inches thick. Fragments of shale make up 50 to 90 percent of this layer. Partly weathered, fractured shale bedrock is generally at a depth of about 15 inches. In some places it lies directly beneath the surface layer, but it is at a depth of as much as 18 inches in other places.

These soils have moderately rapid permeability and very low available moisture capacity. In most places they are strongly acid or very strongly acid. In many places, however, liming has made the plow layer slightly acid or neutral. These soils have low natural fertility. They are fairly well suited to permanent pasture, trees, and wildlife.

Klinesville shaly silt loam, 3 to 8 percent slopes, moderately eroded (KlB2).—This soil is on undulating uplands in the northern half of the county. It has a thicker surface layer than the one in the profile described as typical for the series. Bedrock is at a depth of 12 to 18 inches.

Included with this soil in mapping are areas in which the subsoil is 6 to 14 inches thick and bedrock is at a depth of 18 to 24 inches. In a few areas, the substratum is only slightly acid. Narrow patches of Reaville soils and areas of Reaville soils in depressions are also included.

Permeability is moderately rapid, and the available moisture capacity is very low. Surface runoff is medium to rapid, and there is a severe hazard of erosion.

This soil is used for general farm crops, hay, and pasture. Also, part of the acreage is in grass, shrubs, weeds, and trees and is within golf courses or estates, or in areas surrounding institutions, industries, and residential developments. The soil is fairly well suited to perennial hay and pasture consisting of drought-resistant grasses and legumes, but alfalfa and row crops make low yields. Renovation of pastures or new plantings for pasture or hay ought to be done in alternate contour strips; half of the strips should be planted the first year and the rest the following year. If irrigation water is available, frequent applications will help to maintain fair stands of forage of fair quality. The pastures should not be overgrazed.

Shale and bedrock near the surface are limitations to use of this soil for residential, light industrial, commercial, or institutional developments, and they also make grading and excavating somewhat difficult. Limitations are severe for use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IVs–1, woodland suitability group 11, community development group 6)

Klinesville very shaly silt loam, 3 to 8 percent slopes, severely eroded (KsB3).—This soil is on undulating uplands, narrow ridges, and hilltops in the northern half of the county. Its profile is the one described as typical for the series. In some places the subsoil is thin and shaly and the substratum is very shaly and grades to firm bedrock at a depth of about 2 feet. In many places tillage is within the substratum of raw shale. Bedrock crops out in many areas. In most places 35 to 85 percent of the plow layer is shale, and the rest is organic matter mixed with silt loam. In a few areas, the surface layer is brown or yellowish brown.

Included with this soil in mapping are a few small areas of Reaville and Penn soils. These included Penn soils have a neutral substratum.

Permeability is moderately rapid, and this soil has very low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture, but a large part of the acreage adjacent to residential developments is idle. A small acreage is in estates or is in areas surrounding institutions. This soil is poorly suited to corn, vegetables, and alfalfa. It is suitable for permanent pasture consisting of drought-resistant grasses and legumes, but little grazing is provided in midsummer. Plantings for pasture should be made in alternate contour strips. Half of the strips ought to be planted the first year, and the rest the following year. New plantings can be seeded in a small grain. Rotating the pastures helps to prevent overgrazing.

This soil is suitable for use as woodland or for wildlife habitats. It is fair for plantings of white and Virginia pines.

Shale and bedrock near the surface are limitations to use of this soil for residential, light industrial, commercial, or institutional developments. They make grading, excavating, and landscaping difficult. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIs–4, woodland suitability group 11, community development group 6)

Klinesville very shaly silt loam, 8 to 15 percent slopes, severely eroded (KsC3).—This soil is more sloping than the soil for which a profile is described as typical for the series, and it is generally shallower over bedrock. It is on hills and undulating uplands in the northern half of the county. In a few places, the surface layer is 6 to 8 inches thick and is underlain by a thin, shaly subsoil. In many places bedrock is at a depth of only 6 to 14 inches. Tillage is generally in the substratum, and shale bedrock crops out in many places. Included with this soil in mapping are small areas of Reaville and Penn soils.

This Klinesville soil has moderately rapid or rapid permeability and very low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is poorly suited to field crops, permanent hay, and improved pasture. Much of the acreage is idle and is overgrown with grass, weeds, and brush. Limited grazing of native grass pastures is available in spring and late in fall, but only a small amount of forage is available in summer. This soil is fair for trees. Drought-resistant species, such as Virginia pine and white pine, should be planted.

Bedrock and shale near the surface are severe limitations for grading, excavating, and landscaping. They are also severe limitations to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit VIIs–2, woodland suitability group 11, community development group 7)

Klinesville very shaly silt loam, 15 to 35 percent slopes, severely eroded (KsE3).—This soil is steeper and shallower over bedrock than the soil for which a profile is described as typical for the series. It is on hills and undulating uplands adjacent to drainageways and streams in the northern half of the county.

The surface layer is 4 to 6 inches thick. In many places it consists mainly of shale that has been brought to the surface by plowing and contains little or no fine soil material or organic matter. In a few areas where erosion has been less severe than typical for this soil, the surface layer is dark reddish-brown silt loam and is 6 to 8 inches thick. Bedrock crops out in many places, but it is at a depth of 6 to 14 inches in most places.

Included with this soil in mapping are small areas of a Penn soil that has a neutral substratum and similar slopes. This included Penn soil is underlain by calcareous shale.

This Klinesville soil has rapid permeability and very low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is mainly in pasture or is overgrown with weeds, grass, and brush. It is not suitable for field crops, permanent hay, or improved pasture. This soil is suitable for woodland plantings of white pine, Virginia pine, or other drought-resistant trees, and these trees will reduce the danger of further erosion. (Capability unit VIIs–2, woodland suitability group 11, community development group 8)

Lansdale Series

In the Lansdale series are moderately deep and deep, well-drained soils that are nearly level to steep. These soils formed in material weathered from gray or yellowish-brown sandstone, conglomerate, and shale. They are on undulating and rolling uplands in the south-central part of the county, adjacent to well drained, reddish-brown Penn soils and moderately well drained Readington soils. The Lansdale soils occur in the same general areas as the poorly drained Croton and somewhat poorly drained Abbottstown soils, on low-lying flats, and the very silty, gray, mottled Lawrenceville and Chalfont soils, on gentle slopes and flats.

In a typical profile of a Lansdale soil, the surface layer is very friable, dark-brown silt loam about 7 inches thick. It contains a few small pieces of sandstone.

The subsoil is friable, brown loam about 3 feet thick. It contains a few small pieces of sandstone. The texture of the subsoil is more sandy in the lower than in the upper part. The lower part grades to soft, crumbly sandstone.

The substratum is firm, dark-brown to yellowish-brown loamy sand that is 2 to 3 feet thick and is firmer with increasing depth. Depth to fairly hard bedrock is generally 5 to 6 feet, but it ranges from 3 to 12 feet.

These soils have a moderately permeable subsoil, and their substratum is moderately to rapidly permeable. The supply of moisture held available for plants is generally high. These soils are very strongly acid to medium acid and have moderate natural fertility. They are fairly well suited to most types of farming commonly practiced in the county. Limitations are slight to moderate for use in developments.

Lansdale loam, thin, 3 to 8 percent slopes, severely eroded (LaB3).—This soil has a brown, loamy surface layer in which as much as 35 percent of the soil material consists of pebbles and fragments of sandstone. This soil is severely eroded, and its profile is much thinner over weathered sandstone than that of the Lansdale silt loams. Depth to hard bedrock, however, ranges from 3 to 12 feet.

This soil is on gently sloping or undulating uplands and hilltops in the southern part of the county. It is in a belt, 3 to 4 miles wide, that extends from the town of Oaks, in the western part of the county, to Hatboro, near the line between Bucks and Montgomery Counties. Along the northern edge of the belt, this soil is more silty than normal, and 10 to 75 percent of the profile consists of fragments of shale. The content of shale increases with increasing depth. As much as 95 percent of the material in the lower part of the substratum is shale. In small areas the substratum is exposed at the surface. Reddish-brown and dusky-red streaks are common on some slopes. These colors originated from the red colors in the bedrock.

Permeability is moderate in the subsoil and moderately rapid below the subsoil. The available moisture capacity is high. Surface runoff is medium, and the hazard of erosion is moderate to severe.

This soil is used for commonly grown field crops, hay, and pasture. Many areas surrounding residential developments are in grass, trees, and weeds. The soil is well suited to hay and pasture of drought-resistant grasses and legumes, and it is fairly well suited to alfalfa, corn, soybeans, and winter small grains. Field or contour stripcropping is needed to reduce losses from erosion, conserve moisture, and improve the soil tilth. With the stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 4 years of grass-legume hay. Manure and crop residue should be incorporated into the soil.

This soil has slight limitations for use in residential, light industrial, commercial, or institutional developments. It varies in its limitations for use as a disposal field for the effluent from septic tanks. Where a septic tank is planned, depth to bedrock should be determined and percolation tests ought to be made at the specific site. Knowledge of the depth to bedrock and of the results of percolation tests will help in planning the design of the tile field for such a system. (Capability unit IIIe–3, woodland suitability group 11, community development group 3)

Lansdale loam, thin, 8 to 15 percent slopes, severely eroded (LaC3).—This soil has a profile similar to that of Lansdale loam, thin, 3 to 8 percent slopes, severely eroded, but it is steeper and contains more pieces of sandstone. Erosion tends to concentrate the pebbles and fragments of sandstone on the surface. The substratum is only 10 to 18 inches beneath the surface. Depth to bedrock ranges from only 2 feet to as much as 12 feet.

This soil is on undulating uplands and hills in the south-central part of the county. It occupies small, scattered areas in a belt 3 to 4 miles wide that extends from Oaks in the western part of the county to Hatboro, near the line between Bucks and Montgomery Counties. Along the northern edge of this belt, this soil is more silty than normal. From 15 to 75 percent of it is shale, but the content of shale increases to 95 percent in the lower part of the substratum. A few scattered stones are on the surface, and bedrock crops out in places. In places tillage is in the sandy substratum. On some slopes there are many streaks and broad bands that are reddish brown or dusky red.

Permeability is moderately rapid, and the available moisture capacity is moderate to high. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops and for hay and pasture. Much of the acreage is idle and is overgrown with weeds and brush. The soil is not well suited to corn and small grains, but it is well suited to shallow-rooted grasses and legumes that resist drought. The crops should be planted in alternate field strips or contour strips. Diversion terraces may be needed on the long slopes.

This soil has moderate limitations for residential developments. It has moderate to severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 11, community development group 7)

Lansdale loam, thin, 15 to 35 percent slopes, severely eroded (LaE3).—This soil has a profile similar to that of Lansdale loam, thin, 3 to 8 percent slopes, severely eroded, but it is steeper and shallower over bedrock, and it generally has more fragments of sandstone on the surface. In most places the substratum is at a depth of 10 to 18 inches and bedrock is at a depth of 2 to 8 feet.

This soil is on hills and on short, abrupt slopes adjacent to drainageways. The areas are small and are widely scattered in the south-central part of the county. This soil occurs in a belt, 3 to 4 miles wide, extending from Oaks in the western part of the county to Hatboro near the line between Bucks and Montgomery Counties. Along the northern edge of the belt, this soil is more silty and shaly than normal. In many places the substratum is at the surface. Bedrock crops out in many places, and a few scattered stones are common. On some slopes there are streaks and bands of reddish brown and dusky red.

In most places this soil has moderately rapid permeability. The available moisture capacity is low to moderate. Surface runoff is very rapid, and the hazard of erosion is severe.

This soil is poorly suited to the commonly grown field crops, but it is better suited to permanent pasture and trees. Much of the acreage is idle and is overgrown with weeds and brush. Birdsfoot trefoil, reed canarygrass, and other shallow-rooted legumes and grasses are well suited to pasture. New plantings or seedings for pasture should be made in alternate field or contour strips; half of the strips ought to be planted the first year, and the rest the following year. The pastures ought to be rotated often to prevent overgrazing.

Many of the slopes are more suitable for planting to white or Virginia pines than to pasture. This soil has moderate to severe limitations for residential developments. (Capability unit VIe–1, woodland suitability group 11, community development group 5)

Lansdale silt loam, 0 to 3 percent slopes, moderately eroded (LdA2).—This soil has a surface layer that is 8 to 10 inches thick and a subsoil that is 24 to 40 inches thick. Sandstone bedrock is at a depth of 5 to 10 feet. This soil is on smooth or undulating uplands near Norristown, Ambler, and Hatboro in the south-central part of the county.

In a few places, this soil has a brown or yellowish-brown subsoil of silty clay loam that grades to a substratum of sandy loam. On a few flats and in depressions, the substratum has small gray mottles and black streaks below a depth of 3 feet. In the same areas, the surface layer is dark brown and is 10 to 12 inches thick. In small patches and bands, the sandy substratum is within 2 feet of the surface.

This soil has moderate permeability throughout the subsoil and moderate to rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is slow to medium, and there is a slight to moderate hazard of erosion. Crops grown on this soil respond well to moderate applications of lime and fertilizer.

This soil is used for golf courses or is in grass in areas surrounding institutions, industries, and estates. It is used for and is well suited to fruit, vegetables, nursery stock, corn, winter small grains, and alfalfa. Losses from erosion can generally be reduced, moisture conserved, and good soil tilth maintained by practicing field stripcropping and using a suitable cropping system. An example of such a cropping system is 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and at least 1 year of deep-rooted grasses and legumes

grown for hay. If drainage is needed, random tile drains will help to remove the excess moisture from the depressions and lower lying flats.

This soil has few limitations for residential, light industrial, commercial, or institutional developments. Limitations are also few for use as a disposal field for the effluent from septic tanks, but percolation tests at the site are suggested. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Lansdale silt loam, 3 to 8 percent slopes, moderately eroded (LdB2).—This soil has the profile described as typical for the series. It is on undulating uplands and hilltops in the south-central part of the county. The areas are fairly large and are widely scattered. They occur in a band, 3 to 4 miles wide, that extends from Audubon in the western part of the county to a point near Hatboro, close to the line between Bucks and Montgomery Counties.

The subsoil ranges from 24 to 36 inches in thickness, and the upper part is silty clay loam in a few places. In some areas the sandy substratum is within 24 inches of the surface. In wooded areas occasional widely spaced stones and a layer of leaves and organic matter, about 3 inches thick, are on the surface.

This soil has moderate permeability throughout the subsoil and moderately rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is medium, and there is a moderate hazard of erosion.

A large acreage of this soil is in sod on golf courses, in estates, and surrounding institutional, industrial, and residential sites. This soil is suited, however, to corn, winter small grains, fruit, vegetables, and alfalfa. Losses from erosion can be reduced, moisture conserved, and good soil tilth maintained by practicing field or contour stripcropping, returning crop residue to the soil, and using a suitable cropping system. An example of a suitable cropping system is 2 years of corn, 1 year of a winter small grain, and 2 years of deep-rooted grasses and legumes grown for hay. A cover crop ought to be grown following the first year of corn. Crops grown on this soil respond well to moderate applications of lime and fertilizer. During dry seasons, supplemental irrigation generally increases the yield and improves the quality of the crops. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry off excess surface water.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. It has only slight limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be made at the specific site. (Capability unit IIe–2, woodland suitability group 2, community development group 1)

Lansdale silt loam, 8 to 15 percent slopes, moderately eroded (LdC2).—This soil is steeper than the one for which a profile is described as typical for the series. Also, the subsoil is thinner and bedrock is nearer the surface in many places. This soil is on undulating or hilly uplands in the south-central part of the county. The areas are small and widely scattered. They are in a band 3 to 4 miles wide, extending from Audubon in the western part of the county to Hatboro near the line between Bucks and Montgomery Counties.

The surface layer ranges from 4 to 8 inches in thickness. In some patches the surface layer has a texture of sandy loam, and it contains fragments of sandstone in places. In wooded areas a mat of leaves and organic matter is on the surface and there are occasional stony patches. Quartz pebbles are common on the surface in some areas. The subsoil ranges from loam to sandy clay loam in texture and from 18 to 30 inches in thickness. Bedrock is only 3 feet from the surface in some places, but it is as deep as 10 feet in other places.

This soil has moderate permeability throughout the subsoil, and moderately rapid permeability below the subsoil. The available moisture capacity is high. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Crops to which this soil is well suited are corn, winter small grains, fruit, and alfalfa. Field or contour stripcropping is needed to reduce losses from erosion, to conserve moisture, and to maintain or improve the soil tilth. With the field or contour stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and at least 2 years of grass-legume hay. The crops respond well to moderate or large applications of lime and fertilizer. Moderate applications of irrigation water, applied frequently, generally increase the yield and improve the quality of the crops. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry away excess water and to keep erosion losses to a minimum.

A large acreage of this soil is used for developments of various kinds. Limitations are moderate for residential, light industrial, commercial, or institutional developments. This soil also has moderate limitations for use as a disposal field for the effluent from septic tanks. Percolation tests, however, should be made at the specific site. (Capability unit IIIe–2, woodland suitability group 2, community development group 2)

Lawrenceville Series

In the Lawrenceville series are deep, moderately well drained silty soils that are nearly level or gently sloping. Permeability is moderately slow in a layer in the subsoil, and this layer impedes the downward movement of water and restricts the growth of roots. These soils are on nearly level and undulating uplands, on the lower slopes, and in depressions in the central part of the county. Except where there are scattered fragments of rock just above the bedrock, these soils contain only a few fragments of rock.

The Lawrenceville soils are adjacent to somewhat poorly drained Chalfont and poorly drained Doylestown soils. Near them, on the adjacent uplands, are Readington and Abbottstown soils.

In a typical profile of a Lawrenceville soil, the surface layer is dark grayish-brown silt loam about 15 inches thick. In cultivated areas the uppermost 10 inches of this layer is the plow layer.

The upper part of the subsoil is 15 to 27 inches of friable, yellowish-brown silt loam that has a few gray mottles below a depth of about 20 inches. Yellowish-brown silt loam, prominently mottled with gray, is below this material. The prominently mottled material is firm in place, but when disturbed, it breaks to large

blocks that have a thick, gray surface coating. These blocks are 6 to 8 inches in diameter. They readily break to very small blocks and to thin, flat plates.

At a depth of about 40 inches, the subsoil grades to a firm, strong-brown substratum that is streaked with reddish gray and yellowish red. Depth to the bedrock of dusky-red shale is generally about 5 feet, but it ranges from 4 to 12 feet.

Lawrenceville silt loam, 0 to 3 percent slopes (LeA).—The profile of this soil is the one described as typical for the series. This soil is on the lower slopes and in depressions where it grades to the lower lying Chalfont and Doylestown soils. It occupies areas that are scattered throughout the central part of the county, especially between Norristown and Hatfield or Hatboro.

Near Ambler, small areas that are free of mottling to a depth of 36 inches or more are included in mapping. Also included are small areas where gray mottling occurs above a depth of 15 inches and a fragipan is within 18 to 24 inches of the surface. In some depressions the surface layer is as thick as 20 inches.

This soil is moderately permeable to a depth of 18 to 20 inches, and it is firm and has moderately slow permeability below that depth. The water table is high late in fall, in winter, and early in spring. Surface drainage is slow, and the hazard of erosion is slight to moderate. The soil is strongly acid to medium acid. The available moisture capacity is high, but the growth of roots is restricted in the subsoil.

This soil is well suited to corn, soybeans, ladino clover, timothy, and bluegrass. It is fair for spring-sown small grains, but alfalfa and winter small grains are subject to serious winterkill. If graded-row cultivation is used, a suitable cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and at least 1 year of grass-legume hay (fig. 22). The graded rows allow water to drain away without causing serious erosion.

Many areas of this soil are idle, and many areas have been developed for residential use. The slow permeability, seasonal high water table, and slow surface drainage are limitations to use for residential, commercial, light industrial, or institutional developments. Also, where this soil is disturbed, it is subject to severe erosion.

Figure 22.—**Typical area of Lawrenceville silt loam, 0 to 3 percent slopes. A late-summer cutting of hay has just been completed.**

(Capability unit IIw–2, woodland suitability group 6, community development group 9)

Lawrenceville silt loam, 3 to 8 percent slopes, moderately eroded (LeB2).—The profile of this soil is similar to the one described as typical for the series, but this soil is only on undulating uplands, on benches, and on the long, gentle lower slopes. It grades to Chalfont and Doylestown soils in depressions and on low-lying flats. Areas of this soil are large. They occur throughout the central part of the county, especially in the triangular area from Norristown to Hatfield and Hatboro along the line between Bucks and Montgomery Counties.

In many places this soil is underlain by reddish-brown shaly silt loam at a depth of 30 to 40 inches. In a few small patches, cultivation is in the yellowish-brown subsoil. In swales and depressions, the surface layer is as thick as 12 to 15 inches. Some nearly level areas are included in mapping, especially in the vicinity of Lansdale. In some areas the firm, gray, mottled fragipan is at a depth of 15 to 24 inches. Near Ambler, small areas of this soil are free of gray mottling to a depth of 36 inches or more. In another small acreage, the slopes are stronger than 8 percent.

This soil is moderately permeable to a depth of 15 to 24 inches, and it has moderately slow permeability below that depth. The water table is within a foot of the surface during winter and very early in spring, especially during February and March. This soil is slow to dry out early in spring, but the content of moisture is nearly ideal by corn-planting time. The available moisture capacity is high. Plants may not be able to use all of the available moisture, however, because of the restricted growth of their roots in the subsoil.

Large areas of this soil are in golf courses or surround industrial, residential, and institutional developments. Nurseries are common. This soil is fairly well suited to corn, soybeans, wheat, barley, and other crops commonly grown in the area. Yields of alfalfa and of winter small grains are reduced as the result of frost heaving and winterkill. Graded stripcropping is suggested to conserve moisture, reduce losses from erosion, and maintain good tilth. A suitable cropping system, where graded-stripcropping is practiced, consists of 2 years of row crops, 1 year of a small grain, and 2 years of grass-legume hay. On the long slopes, diversion terraces will further reduce losses from erosion.

This soil has moderate limitations for use in residential, light industrial, commercial, or institutional developments. The slow permeability, seasonal high water table, and susceptibility to erosion are definite hazards to use for developments. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Legore Series

In the Legore series are well-drained, moderately deep or deep soils that are yellowish red and brown. These soils formed in material weathered from diabase. They are moderately sloping to steep and are on hills and ridges in the northern part of the county. The areas are small and widely scattered. They are adjacent to

the deep, well drained Neshaminy and moderately well drained or somewhat poorly drained Mount Lucas soils.

In a typical profile of a Legore soil, the surface layer is brown clay loam that is 4 to 6 inches thick. From 10 to 20 percent of this layer consists of small flat and rounded pieces of diabase rock.

The subsoil is yellowish-red or strong-brown clay loam that is 10 to 15 inches thick and is more sandy in the lower than in the upper part. About 10 percent of it is weathered pieces of diabase.

The substratum is brown sandy loam speckled with grains of red, yellow, gray, white, and black. From 25 to 30 percent of it consists of small pieces of diabase rock. Some of the pieces are so soft that they can be crushed in the hand to a coarse sand. They are harder and increase in number, however, with increasing depth. The substratum grades to bedrock at a depth of 2 to 5 feet.

The Legore soils are moderately permeable and have moderate to high available moisture capacity. They are moderately acid to slightly acid and have low natural fertility. These soils are suited to pasture and trees.

Legore clay loam, 8 to 15 percent slopes, severely eroded (LgC3).—This soil has a profile like the one described as typical for the series. It is in widely scattered areas on hills and ridge slopes in the northern third of the county. This soil is on the same slopes as the Neshaminy soils; near it, in slight depressions and on toe slopes, are areas of Mount Lucas soils.

Included with this soil in mapping are areas of severely eroded Neshaminy soils. Occasional large stones are on the surface, and bedrock crops out in a few places. In some places erosion has exposed the substratum.

This soil is moderately permeable and has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used mostly for pasture or is idle and overgrown with weeds and brush. It is well suited to perennial hay or pasture of drought-resistant grasses and legumes, such as alfalfa, birdsfoot trefoil, and reed canarygrass. New plantings and reseedings should be made in field or contour strips. Half the strips ought to be planted the first year and the rest the following year. If this soil is used for crops grown in rotation, a long rotation consisting of 3 or more years of hay, 1 year of a cultivated crop, and 1 year of a small grain is suitable.

This soil has limitations for use in residential developments. It has severe to moderate limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Legore clay loam, 15 to 30 percent slopes, severely eroded (LgD3).—This soil is steeper and shallower over bedrock than the one for which a profile is described as typical for the series. Also, the subsoil is generally thinner and more sandy. This soil is in widely scattered areas on hills and ridge slopes in the northern part of the county. It is adjacent to the Neshaminy and Brecknock soils. In many places bedrock crops out on the surface, and large, round stones are common.

Included with this soil in mapping are a few areas of severely eroded Neshaminy soils. The subsoil is thicker in the included areas than normal for this Legore soil.

This soil is moderately permeable and has moderate available moisture capacity. Surface runoff is rapid or very rapid, and the hazard of erosion is severe.

Most areas of this soil are idle and have a cover of grass, weeds, and brush. This soil is suitable for pasture or trees. In the areas to be used for pasture, shallow-rooted, drought-resistant grasses and legumes should be planted in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The steeper slopes ought to be planted to white pine or Virginia pine. This soil is also suitable for wildlife habitats if it is planted to grasses and shrubs that offer food and cover for birds and small game animals. (Capability unit VIe–1, woodland suitability group 4, community development group 8)

Lehigh Series

The Lehigh series consists of moderately deep to deep soils that are moderately well drained or somewhat poorly drained. These soils formed on hard, gray or black metamorphosed shale, called hornfels. They have a slowly permeable layer in the subsoil that restricts the downward movement of water.

These soils are on low ridges and on broad-topped hills in the northern part of the county. They are adjacent to well-drained Brecknock and poorly drained Croton soils. In some parts of the county, they are adjacent to Penn and Reaville soils. The Lehigh soils are generally less steep than the Brecknock soils and less reddish than the Penn and Reaville soils.

In a typical profile of a Lehigh soil, the surface layer is dark grayish-brown channery silt loam about 6 inches thick. Flat pieces of very dark gray rock, 2 to 12 inches across, make up 35 percent of this layer.

The subsoil is grayish-brown channery silt loam or silty clay loam about 15 inches thick. It is mottled at a depth of about 15 inches with dark yellowish brown and reddish gray. From 30 to 50 percent of the subsoil consists of flat fragments of rock.

The substratum is between a depth of 21 and 30 inches. It is dark grayish-brown very channery silt loam, and it contains streaks of gray and strong brown. As much as 90 percent of this layer consists of fractured pieces of rock. Depth to very dark gray bedrock is generally about 30 inches, but it ranges from 24 to 48 inches.

These soils have a slowly permeable subsoil and low to moderate available moisture capacity. The water table is at a depth of 1 to 2 feet during winter and early in spring. The soils are very strongly acid to moderately acid and have low natural fertility.

The Lehigh soils are suited to general farming. They have some limitations for use in residential developments.

Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded (LhA2).—This soil has a surface layer of very dark grayish-brown channery silt loam about 8 to 9 inches thick. The subsoil is 18 to 24 inches thick and is mottled at a depth of 12 to 18 inches. Thi soil is on broad upland flats and in depressions in the northern part of the county. Adjacent to it on the lower slopes are the poorly drained Croton soils.

Included with this soil in mapping are areas in which the surface layer is dark-colored silt loam to a depth of

as much as 18 inches. Mottling, in some places, is prominent just below the plow layer.

This soil is slowly permeable and has a high water table that is within a foot of the surface late in fall, in winter, and early in spring. The soil is slow to dry out in spring, and some seepage areas and areas in depressions remain wet during the early part of the growing season. Surface drainage is slow, and the hazard of erosion is slight to moderate. The available moisture capacity is moderate.

This soil is used for the commonly grown field crops, hay, and pasture. Many areas are idle and are overgrown with weeds, brush, and cedar trees (fig. 23). The soil is well suited to hay and pasture consisting of grasses and legumes that tolerate wetness, for example, birdsfoot trefoil, reed canarygrass, timothy, orchardgrass, and ladino clover. This soil is fair for corn, but it is generally unsuitable for alfalfa and for winter small grains. Adequate drainage improves its usefulness for crops. Graded strips or rows are needed to reduce erosion and to safely remove excess surface water. If cultivated crops are grown, a suitable cropping system consists of 1 year of a spring-seeded small grain and at least 3 years of grass-legume hay of adapted varieties. Tile drains help to relieve wetness caused by seeps and springs.

The high water table, slow surface drainage, very slow permeability, and numerous fragments of rock are limitations to use of this soil for residential, light industrial, commercial, or institutional developments. This soil also has severe limitations to use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–2, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 3 to 8 percent slopes, moderately eroded (LhB2).—This soil has a profile like the one described as typical for the series. It is on broad undulating hilltops and narrow ridges in the northern part of the county.

Included with this soil in mapping are small areas in which the surface layer is as much as 1 foot thick. Also included, near Sumneytown and Niantic, are areas in which the lower part of the subsoil and the substratum are nearly neutral. The subsoil in a few areas is thicker and browner than the one in the profile described as typical for the series. Less than 20 percent of it consists of coarse fragments.

Figure 23.—Small, rectangular fields of Lehigh channery silt loam, 0 to 3 percent slopes, moderately eroded. These fields, bordered by cedar trees and poison-ivy, are typical of fields made up of this soil.

This soil is slowly permeable during winter and early in spring, and the water table is only 1 to 2 feet beneath the surface. The soil dries out and warms slowly in spring, but it is droughty during summer. The available moisture capacity is moderate. Surface drainage is medium, and there is a moderate hazard of erosion.

This soil is used for the commonly grown field crops and for hay and pasture. Some areas, however, consist of brushy woodland or are overgrown with weeds and cedar trees. This soil is well suited to perennial hay or pasture of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought.

Adequate drainage improves the usefulness of this soil for field crops, but ladino clover and orchardgrass are fair for hay and pasture. This soil is fair for corn, soybeans, and spring-sown oats and barley, but winter small grains are subject to damage from frost heaving. Wetness makes the soil poorly suited to alfalfa.

If cultivated crops are grown, a suitable cropping system consists of 1 year of a row crop with a cover crop, 1 year of a small grain, preferably seeded in spring, and at least 3 years of grass-legume hay. Graded stripcropping is needed to reduce losses from erosion and to remove excess surface water.

Wetness is a limitation to use of this soil for residential, light industrial, commercial, or institutional developments. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIw–3, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 3 to 8 percent slopes, severely eroded (LhB3).—This soil has a surface layer of grayish-brown or olive-gray channery silt loam that is 5 to 6 inches thick. As much as 50 percent of the surface layer consists of flat fragments of rock. The subsoil is 6 to 12 inches thick. This soil is on undulating hilltops and narrow ridges in the northern part of the county. The areas near Sumneytown and Tylersport in the northeastern part of the county have a nearly neutral subsoil and substratum.

Included with this soil in mapping are small areas in which the surface layer is thicker and less channery than the one in the profile described as typical for the series. In places mottling is at a depth of only 10 to 12 inches.

This soil is slowly permeable and has a high water table within a foot of the surface in winter and early in spring. The moisture level is right for plowing, fitting, and planting for only a short time before the soil becomes too dry. The available moisture capacity is low. Surface drainage is medium to rapid, and the hazard of erosion is severe in most places.

This soil is used for the commonly grown field crops, but it is better suited to hay and pasture. A large part of the acreage is idle and is overgrown with weeds, brush, and cedars. The soil is well suited to perennial hay or pasture consisting of shallow-rooted, drought-resistant plants that tolerate wetness during winter and spring. It is well suited to birdsfoot trefoil and reed canarygrass for hay and pasture. This soil is poorly suited to corn, small grains, and alfalfa.

Where this soil is cultivated, a cropping system of low intensity should be used. An example of such a cropping system is 1 year of a cultivated crop, 1 year of a small grain, and 3 or 4 years of hay. Where necessary for highest production, the areas in hay or pasture should be reseeded in alternate graded strips. Half of the strips ought to be planted the first year and the rest the following year. Diversion terraces and constructed waterways will help to reduce losses from erosion on the long slopes. Supplemental irrigation, if water is available, increases the yield and improves the quality of the crops.

Shallowness and the high water table, slow permeability, and numerous flat fragments of rock are severe limitations to use of this soil for residential, light industrial, commercial, or institutional developments. Also, this soil has severe limitations for use as a disposal field for the effluent from septic tanks. All developments should be connected to an adequate municipal system for treating and disposing of sewage. (Capability unit IVe–4, woodland suitability group 7, community development group 9)

Lehigh channery silt loam, 8 to 15 percent slopes, moderately eroded (LhC2).—This soil is steeper than the one for which a profile is described as typical for the series. Also, it is more channery in some places and has a thinner subsoil. This soil is on hills and ridges in the northern part of the county. The areas near Sumneytown, Tylersport, and Niantic have a nearly neutral subsoil and substratum.

Included with this soil in mapping are wooded areas in which little or no erosion has taken place; areas at the foot of some slopes where the surface layer is 10 to 12 inches thick; and areas where mottling occurs just below the plow layer. In some places the profile of this soil is redder or browner than the one described as typical for the series.

This soil is slowly permeable and has a high water table within 1 to 2 feet of the surface late in winter and early in spring. Many seeps and springs occur near the base of slopes and at points where the bedrock is nearest the surface. Surface drainage is rapid, and the hazard of erosion is severe. The available moisture capacity is low to moderate.

A large acreage of this soil is wooded or is overgrown with weeds, brush, and cedars. Also, part of the acreage is used for the commonly grown field crops, hay, and pasture. This soil is well suited to perennial hay and pasture consisting of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought. It is fair to poor for corn and spring-seeded small grains. Generally, wetness makes it poor for alfalfa and winter small grains.

If this soil is cultivated, the crops should be planted in graded strips. A suitable cropping system to use with the graded strips is 1 year of a row crop followed by a cover crop, 1 year of a spring-seeded small grain, and 3 years of grass-legume hay. Diversion terraces help to reduce losses from erosion on the long slopes. On the lower slopes, tile drains may help to relieve wetness caused by seepage.

This soil has moderate to severe limitations for large residential developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–7, woodland suitability group 7, community development group 10)

Lehigh channery silt loam, 8 to 15 percent slopes, severely eroded (LhC3).—In most places this soil has a surface layer of grayish-brown or olive-gray channery silt loam 5 to 6 inches thick. As much as 60 percent of the surface layer consists of flat pieces of rock. The subsoil is also very channery and ranges from 6 to 12 inches in thickness. Depth to bedrock ranges from 2 to as much as 4 feet. This soil is on hills and ridges in the northern part of the county.

Though the surface layer is generally grayish brown or olive gray, its color ranges to reddish gray and dark yellowish brown in some places. In areas of this soil near Sumneytown, Niantic, and Tylersport, the reaction is nearly neutral throughout the profile.

Included with this soil in mapping are areas in which mottling is in or just below the surface layer. Also included are small areas in which the slopes are more than 15 percent.

This soil is slowly permeable and has a high water table within a foot of the surface during winter and early in spring. Many seeps and springs persist well into the spring months. Although this soil dries slowly early in spring, it soon becomes droughty. It has low available moisture capacity. Surface drainage is rapid, and the hazard of erosion is severe. To some extent, this soil is used for the commonly grown field crops, hay, and pasture. A large acreage is idle, however, and is overgrown with brush, weeds, and cedars. This soil is well suited to perennial hay and pasture consisting of shallow-rooted grasses and legumes, such as birdsfoot trefoil and reed canarygrass, that tolerate both wetness and drought. It is poorly suited to corn, small grains, and alfalfa.

If this soil is used for crops grown in rotation, a long rotation consisting of 1 year of a cultivated crop, 1 year of a small grain, and 4 years of hay is suitable. Hayfields and pastures that are to be renovated should be reseeded in alternate graded contour strips. Half the strips ought to be planted the first year, and the rest the following year. The pastures should be clipped, top-dressed, and rotated for best yields. Most areas of this soil are too shallow for installing tile drainage.

This soil has severe limitations for residential developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–4, woodland suitability group 7, community development group 10)

Lehigh very stony silt loam, 0 to 8 percent slopes (LsB).—On the surface this soil has about 1 inch of partly decomposed leaves. Beneath the leaves is about 1 inch of very friable, very dark brown silt loam over about 8 inches of very friable, dark grayish-brown stony silt loam. The subsoil and substratum are similar to the ones in the profile described as typical for the series. This soil not only contains fragments 2 to 3 inches across, but in addition, 2 to 20 percent of it consists of flat stones 15 to 25 inches across. This soil is on the summits and lower benches of hills and ridges in the northern part of the county.

Included with this soil in mapping are small wooded areas that are nearly free of stones. In areas of this

soil near Niantic and along the Unami and Ridge Valley Creeks near Sumneytown, the reaction is nearly neutral in the subsoil and substratum.

This soil is slowly permeable and has a high water table only 1 to 2 feet beneath the surface in winter and early in spring. Areas of this soil in depressions and on the lower slopes are slow to dry out in spring. In some years the soil remains wet into the early part of the growing season. Surface drainage is slow, and there is a slight hazard of erosion. The available moisture capacity is moderate.

This soil is used to a small extent for pasture, but most of it is in wooded areas or is overgrown with brush, weeds, and cedars. The soil is fairly well suited to pasture if enough stones can be economically removed to permit the use of machinery. Reed canarygrass, birdsfoot trefoil, bluegrass, and timothy are suitable for planting in the pastures. Desirable trees for planting in weedy or open areas of woodland are white pine, larch, and Norway spruce. (Capability unit VIs–3, woodland suitability group 7, community development group 9)

Lehigh very stony silt loam, 8 to 25 percent slopes (LsD).—This soil is similar to Lehigh very stony silt loam, 0 to 8 percent slopes, but it is steeper, has a slightly thinner surface layer and subsoil, and has outcrops of bedrock in some places. This soil is on hills and ridges in the northern part of the county. Near Niantic and along Unami Creek near Sumneytown, this soil has a nearly neutral subsoil and substratum.

Included with this soil in mapping are areas in which rounded stones and boulders, as large as 6 feet in diameter, are on the surface. Also included are other small areas of soils that have little or no mottling in the subsoil and small patches of Croton soils near the bottom of some slopes.

This Lehigh soil is slowly permeable and has a high water table that is only 1 to 2 feet beneath the surface in winter and early in spring. Springs and seeps occur on the lower slopes and in areas where the bedrock crops out. Surface drainage is medium, and the hazard of erosion is slight to moderate. This soil has low to moderate available moisture capacity.

About two-thirds of the total acreage is in wooded areas. Also, a small acreage is in pasture, and the rest is overgrown with scrub trees, weeds, and cedars. This soil can be cleared and used for pasture, but it is better suited to trees and to wildlife habitats. Suitable trees for replanting are Norway spruce, larch, and white pine. This soil is well suited to birdsfoot trefoil and reed canarygrass. (Capability unit VIs–3, woodland suitability group 7, community development group 10)

Made Land

Made land is extensive and varied in Montgomery County. It consists of areas where earthmoving during development has removed or altered the characteristics of the original soils. The largest areas of Made land are in the southern part of the county and at population centers, such as Norristown, Pottstown, Lansdale, and Ambler. In addition, many smaller areas of Made land, occupied by industrial, residential, commercial, and institutional developments, are scattered throughout the county, even in the rural areas.

The original soils are converted to Made land in many different ways. Grading and leveling for a large residential development, for example, may remove several feet of soil material from a knoll and deposit this material over a soil in a depression. The solum of the low-lying soil is thereby greatly thickened, and only about 6 inches of soil material is left over bedrock in the formerly deep soil on the knoll.

Deep cut and fill operations involved in making modern highways; construction of earthen structures such as dikes and ponds; construction of landfill and sedimentation basins; quarrying and mining; and the digging of foundations and cellars all create other areas of Made land. If a large parking lot is constructed, for example, on a deep, nearly level, well-drained Chester soil, Made land is created. The surface layer and perhaps the upper part of the subsoil of the Chester soil are removed. Crushed stone is placed over the remaining soil material, and concrete is placed over the stone. As a result, the area that was once occupied by a moderately to rapidly permeable Chester soil is changed to an area that is completely impervious to water, and surface runoff is increased to 100 percent.

Specific physical and chemical properties and interpretations for an area of Made land cannot be listed. On the basis of knowledge of the original soils from which Made land was formed, however, the broad range of properties and the probable limitations can be determined.

In this county areas of Made land have been classified on the basis of the soil material from which they were made or on the basis of the bedrock or other material from which the soil material originated. All the statements concerning a specific mapping unit of Made land are considered typical for the unit, but a number of variations and inclusions occur within a small area.

Made land, diabase, gabbro materials (Ma).—This miscellaneous land type is the result of altering and mixing soils formed in material weathered from dark-colored igneous rocks. The altered soils were mainly of the Neshaminy, Mount Lucas, and Watchung series. This land type is mainly nearly level or gently sloping, but moderately sloping and steep areas are included in a few places. It is on low-lying flats and on undulating uplands in the northern half of the county. The areas are mostly small and are widely scattered. The largest areas are east of Pottstown.

Red to brown or gray silty clay loam that is sticky and plastic when wet makes up this land type. Gray colors are predominant in the low-lying areas. The silty clay loam is mixed with sand and small pieces of rock. In some places it contains large, very hard, round stones and boulders 1 to several feet in diameter. Hard bedrock crops out at the surface in some places, but bedrock is at a depth of as much as 12 feet.

This land type is generally slowly permeable. In some years it has a water table at a depth of 1 to 4 feet late in fall, in winter, and early in spring. In the low-lying areas, the soil material is slowly permeable; the water table is at the surface or water is ponded in depressions until early in spring. The estimated available moisture capacity is moderate. Leveling is difficult because of the stones and smaller fragments of rock. The soil material is slightly acid to neutral.

This land type is used for residences and industries. The stones, plasticity of the soil material, areas that have a high water table, and variable depth to bedrock are limitations for residential development. These limitations make special design necessary and make maintenance difficult. Unless satisfactory results are obtained from percolation tests performed at the site, this land type is likely to have limitations for use as a disposal field for the effluent from septic tanks. Trees, grass, and shrubs grow well, but lawns may be difficult to establish and maintain because of the stones and smaller fragments of rock. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Made land, land fill and sediment basins (Mb).—This land type resulted when man deposited large quantities of soil material and waste products on the surface of other soils. It occupies small, scattered areas throughout the county but is mainly along the Schuylkill River and other streams within the county. The areas are nearly level or gently sloping.

In some places this land type consists of soil material and fragments of rock deposited on low-lying flats and used for constructing buildings above the level reached by high water. In various places along the Schuylkill River, it consists of stream-carried screenings of silt and coal that have been dredged from the river and deposited in constructed basins. In still other places, it consists of industrial waste that has been deposited in similar basins. It also includes areas of sanitary land fill where waste material, other than sewage, has been dumped in old quarries and in large trenches that have been constructed and covered over with soil material.

All the characteristics of this land type are variable. As a rule, permeability depends upon the amount of compaction and on the quality and quantity of the fill. The fill is commonly placed on low-lying areas, and the water table is likely to rise within it unless artificial drainage has been provided.

This land type has limitations for residential, light industrial, commercial, and institutional developments, unless the areas are expressly designed and built for those uses. If the areas are on narrow flood plains, they restrict the stream channel. As a result, the floodwaters rise to a higher level than they formerly did and the velocity of the stream through the areas and below them is increased. This land type is generally not suitable for use as a disposal field for the effluent from septic tanks. Grass, trees, and shrubs grow well in some of the areas, but little or no vegetation grows in areas where industrial waste and coal sediments have been deposited. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 3)

Made land, limestone materials (Mc).—This land type is the result of altering and mixing of soils formed in material weathered from limestone. The areas are mainly nearly level or gently sloping, but a few moderately sloping and steep areas are included. The land type occupies large tracts on nearly level and undulating uplands in the south-central part of the county, from Valley Forge State Park to Willow Grove. The altered soils were mainly those of the Duffield and Lawrenceville series on uplands and of the Rowland and Codorus series on flood plains.

Yellowish-red to yellowish-brown silty clay loam or silt loam, mixed with small pieces of rock, make up most of this land type. In a few places, hard white or gray limestone crops out at the surface. Bedrock is at a depth between 1 and 15 feet, however, in most places. In some places this land type is very silty and is free of pieces of rock. In a few small areas, it contains sand and many small, rounded pebbles. In low-lying areas where there is a seasonal high water table, a very firm, gray, mottled layer is at a depth of 1 to 5 feet.

Some areas of this land type are moderately permeable. In those areas the water table is at a depth of 3 to 5 feet in winter and early in spring. In the low-lying areas, the soil material is slowly permeable below a depth of 1 to 5 feet and the seasonal high water table is often within a foot of the surface. In still other places, the water table never rises to within less than 15 feet of the surface. The estimated available moisture capacity is moderate. Runoff is medium to rapid, and the hazard of erosion is severe unless adequate ground cover is provided. This land type is medium acid and has high natural fertility.

This land type is used mainly for industrial, commercial, and residential developments, and a large acreage is occupied by limestone quarries (fig. 24). Limitations for developments are slight to moderate. Careful investigation of the site is required if a development is planned, because of the solution channels in the bedrock. Special designs may be needed if heavy structures and highways are planned. Susceptibility to erosion, the possibility of a seasonal high water table, and varying depth to hard bedrock are limitations that may make necessary special design and maintenance.

This land type has severe limitations if it is used as a disposal field for the effluent from septic tanks. Rapid percolation and inadequate filtration through the soil material, as well as the solution channels in the bedrock, may cause contamination of the underground water. Where the soil material is not stony, trees, lawns, and shrubs generally grow well if moderate amounts of lime and fertilizer are applied. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Figure 24.—Large, deep limestone quarry in an area of Made land, limestone materials. This quarry is at Bridgeport.

Made land, schist and gneiss materials, sloping (MdB).—This land type is the result of altering and mixing of soils formed in material weathered from schist and gneiss. It is mostly nearly level and gently sloping, but some steep areas and fill escarpments are included. The areas are mainly large, but some are small. They are on smooth and undulating uplands in the southern third of the county. The largest areas surround Narberth, Jenkintown, and Rockledge. The soils changed were formerly in the Chester, Manor, Edgemont, Glenelg, and Glenville series.

Yellowish-red to yellowish-brown loam or silt loam mixed with many pieces of rock make up this land type. In most places the soil material contains a large amount of mica that glitters in the sunlight and imparts a soft, slippery feel to the material. Some areas are sandy, and some contain flat or large, round stones. In places bedrock crops out at the surface, but it is as deep as 15 feet in other places. Near Wyndmoor and Cedarbrook, this land type is more reddish than in other areas, and it contains much gravel of many different sizes.

In depressions or low-lying flats where this land type occurs, the water table rises to within a foot of the surface during winter and early in spring. The estimated available moisture capacity is medium, and runoff is medium. The hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is strongly acid and is medium to low in natural fertility.

This land type is used for residential, industrial, commercial, and institutional developments. It has slight to moderate limitations for residential developments. The main limitations are susceptibility to erosion, a possible seasonal high water table in the low spots, and occasional stones.

This land type varies in its limitations for use as a disposal field for the effluent from septic tanks. Percolation tests should be made at the site to determine whether a specific location is suitable. Lawns, shrubs, and trees grow well if a moderate to large amount of lime and a suitable fertilizer are applied. In some places stones and fragments of rock are too numerous for a lawn to be established. Supplemental irrigation greatly improves the quality of plants used for landscaping, if a moderate amount of water is applied during dry seasons. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 1)

Made land, schist and gneiss materials, strongly sloping (MdD).—This land type is the result of altering and mixing of soils formed in material weathered from schist and gneiss. It is in many narrow areas on hillsides and ridges in the southern third of the county, mainly along drainageways and streams. The areas are mostly moderately sloping to moderately steep, but a few gently sloping areas are included, generally along streams. Most of the changed soils were formerly in the Manor, Glenelg, and Edgemont series.

Yellowish-red to yellowish-brown channery loam or silt loam makes up this land type. In most places the soil material contains a large amount of mica that glitters in the sunlight and imparts a soft, slippery feel to the material. Many areas are sandy, and occasionally there are flat or round stones. Outcroppings of bedrock occur on the steeper slopes, but bedrock is as much as 15 feet from the surface in some places.

Runoff is rapid, and the estimated available moisture capacity is medium. The hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is strongly acid and has moderate to low natural fertility.

This land type is used mainly for institutions and for residences in or near cities. Where it is used for residential developments, it has limitations, mainly the high content of stones, steep slopes, and variable depth to bedrock.

This land type has severe limitations for use as a disposal field for the effluent from septic tanks. Percolation tests should be made at the specific site to determine suitability. If this land type is used as a field for a septic tank, surface seepage is likely to occur downslope where the gradient of the slope is greater than 12 percent. Trees and shrubs grow well if enough lime is added, if they are properly fertilized, and if supplemental irrigation water is supplied during dry seasons. If a lawn is to be established, the fragments of rock and stones must be removed. Also, a large amount of lime and fertilizer ought to be applied, and water should be added frequently and in large amounts during dry periods. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 2)

Made land, shale and sandstone materials, sloping (MeB).—This land type is the result of altering and mixing of soils formed in material weathered from shale and sandstone. It is in large areas throughout the central part of the county and near urban centers to the north. Many smaller tracts are widely scattered throughout the northern half of the county. This land type is mainly nearly level and gently sloping, but some moderately sloping and steep areas are included. It is on low-lying flats and on undulating uplands. Most of the soils were formerly in the Penn, Readington, Abbottstown, Croton, Reaville, Klinesville, Brecknock, Lehigh, Chalfont, Doylestown, and Lawrenceville series.

Dusky-red to yellowish-brown shaly silt loam to channery sandy loam makes up much of this land type, and many areas consist entirely of pieces of shale. Also, in the south-central part of the county, some areas consist entirely of sand and soft sandstone. In the northern part of the county, along the Schuylkill River, some areas consist of gravelly silty clay loam mixed with shale. In a few places in the northern half of the county, some areas consist of olive-gray very channery silt loam. Bedrock crops out in many places, but depth to bedrock is as much as 6 feet. This land type contains occasional stones. Streaks and patches of gray silty clay loam are prominent in the lower lying areas. In the southeastern part of the county, especially near Willow Grove, the soil material is very silty in places and is poorly suited to engineering purposes.

The estimated permeability ranges from moderate to very slow. The water table is at the surface in some seasons, but depth to the water table is as much as 4 feet at other times. Water is frequently ponded on the surface during winter and spring. Seeps and springs are common. The estimated available moisture capacity

is moderate to very low. Runoff is rapid to very slow, and the hazard of erosion is likely to be severe unless adequate cover is provided. The soil material is medium acid to very strongly acid and has moderate to low natural fertility.

This land type is used for residential, industrial, commercial, and institutional developments. It has some limitations for residential developments, mainly the seasonal high water table, shallowness to bedrock, slow permeability, and content of shale and stones.

This land has limitations for use as a disposal field for the effluent from septic tanks. It is only fair for growing trees, shrubs, and grass for landscaping. If a lawn is to be established, topsoil must be added before the area is seeded, and the shale, stones, and fragments of rock must be removed. During summer, supplemental water is needed. A moderate or small amount of water is required, but it must be applied at frequent intervals. Moderate amounts of lime and fertilizer are needed. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 9)

Made land, shale and sandstone materials, strongly sloping (MeD).—This land type is the result of altering and mixing soils formed in material weathered from shale and sandstone. It is in small to large areas on rolling and hilly uplands, mainly in the northern two-thirds of the county. The areas are mostly moderately sloping to moderately steep, but some gentle upland slopes and nearly level areas along streams are included. The changed soils in the northern part of the county were formerly in the Penn, Lansdale, Klinesville, Brecknock, Reaville, and Lehigh series. Those in the south-central part were in the Chalfont, Doylestown, and Lawrenceville series and developed in silty material.

Dusky-red to yellowish-brown shaly silt loam to channery sandy loam makes up this land type. In many places bedrock crops out at the surface, but the depth to bedrock in other places is as much as 4 or 5 feet. In some areas this land type consists only of broken shale or of sand and soft sandstone. In the northern half of the county, some areas consist of olive-gray very channery silt loam.

Permeability ranges from rapid to slow. At times, water is ponded on the surface, but at other times, the water table is at a depth of as much as 3 feet or more. Seeps and springs are common on the lower slopes in winter and spring. The estimated available-moisture capacity is low or very low. Runoff is rapid or very rapid, and the hazard of erosion is severe. The soil material is medium acid to very strongly acid and has low natural fertility.

This land type is used mainly for residential developments, but industries, institutions, and quarries occupy part of it. It has severe limitations for residential developments. The main limitations are the shallowness to the high water table and bedrock, the content of shale and stones, and the steep slopes.

Limitations are severe if this soil is used as a disposal field for the effluent from septic tanks. (Not placed in a capability unit, because the areas have been greatly disturbed by man; woodland suitability group 12, community development group 10)

Manor Series

The Manor series consists of moderately deep or deep soils that are well drained. These soils formed in material weathered from schist and gneiss. The areas are widely distributed on hills and ridges in the southern part of the county. These soils occupy a large part of the county south of the limestone valley.

The Manor soils are adjacent to the moderately deep or deep, well drained Glenelg soils and moderately well drained Glenville soils that are in depressions and on the lower slopes. They are also adjacent to the deep, well-drained Chester soils, on broad undulating uplands.

In a typical profile of a Manor soil, the surface layer is friable, dark grayish-brown channery silt loam about 7 inches thick. About 15 to 25 percent of it consists of small, flat pieces of rock.

The subsoil is yellowish-brown channery silt loam about 10 inches thick. In places 20 to 50 percent of the lower part consists of flat fragments of rock and enough mica to give the soil material a slippery feel. The soil material in the subsoil grades to the sandy or loamy substratum.

The upper part of the substratum is friable to firm, strong-brown channery loam or sand, and the lower part is very friable, dark grayish-brown loamy sand. The substratum contains small, flat pieces of rock. It also contains a large amount of mica that glitters in the sunlight and gives the soil material a greasy feel if it is rubbed between the fingers. In some places the substratum contains firm gneiss. Hard bedrock is generally at a depth of 4 to 5 feet, but the depth ranges from 2 to 10 feet or more.

The Manor soils that formed in material weathered from schist have a silty substratum. Those that formed in material weathered from gneiss tend to have a sandy substratum.

These soils are moderately permeable and have moderate to low available moisture capacity. Their reaction ranges from very strongly acid to slightly acid, and they have low natural fertility. Crops grown on these soils respond well to frequent applications of lime and fertilizer if there is enough moisture. These soils are suited to uses in which a cover of grass, trees, or shrubs is required.

Manor channery silt loam, 3 to 8 percent slopes, moderately eroded (MhB2).—This soil is on undulating hilltops and narrow ridges in the southern third of the county. In most places its profile is the one described as typical for the series. In areas adjacent to narrow drainageways, gullies, and abrupt changes in slope, however, the surface layer is dark-brown channery loam that is about 5 inches thick. Occasional stones occupy about 1 percent of the surface. On some of the narrower ridges, bedrock crops out in a few places.

Included with this soil in mapping are a few small areas of Edgemont and Glenelg soils. Also included are a few nearly level areas and wooded areas where slight erosion has taken place.

This soil is moderately permeable and has moderate to low available moisture capacity. Surface runoff is medium, and there is a moderate hazard of erosion.

This soil is used, to a small extent, for fruit, nursery stock, and pasture. Only a small acreage is in general field crops. Most of the acreage has a cover of grass, trees, shrubs, or weeds and is in parks, golf courses, wooded areas, estates, institutions, and areas surrounding residential developments.

This soil is fair for corn and alfalfa. Where it is used for crops, however, either field or contour stripcropping is needed on most slopes to reduce erosion and to conserve moisture. A suitable cropping system consists of 1 year of a row crop, 1 year of a winter small grain, and 2 to 3 years of grass-legume hay. If water is available, supplemental irrigation will increase the yields and improve the quality of the crops.

This soil has slight to moderate limitations for residential, light industrial, commercial, and institutional developments. The thick, micaceous substratum that generally underlies this soil is elastic and unstable. Therefore, special handling may be required if heavy structures are to be installed. Because of variations in depth to bedrock, this soil varies in limitations for use as a disposal field for the effluent from septic tanks. Percolation tests ought to be made and depth to bedrock should be determined at the specific site where a septic tank is planned. (Capability unit IIe–4, woodland suitability group 3, community development group 3)

Manor channery silt loam, 8 to 15 percent slopes, moderately eroded (MhC2).—This soil is on hills and ridges in the southern third of the county. It is steeper than the soil for which a profile is described as typical for the series, and the surface layer and subsoil are generally thinner. The subsoil ranges from 6 to 12 inches in thickness.

Included with this soil in mapping are severely eroded patches and entire slopes that are severely eroded. In those areas, tillage is in the substratum if the areas are cropped. Also included are wooded areas that are covered by about 2 inches of leaves and leaf mold. Beneath the leaves and leaf mold is about 1 inch of very dark grayish-brown silt loam over 7 inches of yellowish-brown channery silt loam. Occasional stones, 1 to 4 feet in diameter, and patches of exposed bedrock occupy as much as 3 percent of the surface in some areas. Other inclusions consist of a few areas of sloping, severely eroded Glenelg soils that have a subsoil of strong-brown channery silt loam 12 to 18 inches thick.

This Manor soil has moderate to moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

Most of the acreage is in grass, shrubs, trees, or weeds in parks, golf courses, estates, wooded areas, and areas surrounding institutions and residential developments. Only a small acreage is used for field crops, fruit, nursery stock, and pasture. This soil is well suited to hay and pasture consisting of drought-resistant grasses and legumes, but it is only fair for corn and winter small grains.

If this soil is cultivated, it should be planted in field or contour strips. A suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and 3 years of grass-legume hay. Incorporating manure, cover crops, and crop residue into the soil helps to maintain or increase the content of organic matter. All depressions, gullies, and severely eroded areas should be kept in permanent grass.

This soil has moderate limitations for commercial, light industrial, institutional, or residential developments. Because of varying depth to bedrock, it varies in its limitations for use as a disposal field for the effluent from septic tanks. Percolation tests and determination of depth to bedrock are desirable at the specific site to determine suitability for use as a disposal field for a septic tank. (Capability unit IIIe–4, woodland suitability group 3, community development group 4)

Manor channery silt loam, 15 to 35 percent slopes, moderately eroded (MhE2).—This soil is more channery and is shallower over the substratum than the one for which a profile is described as typical for the series. It is on hills and ridges in the southern third of the county.

Although bedrock crops out on the surface in many places, the normal depth to bedrock is between 2 and 10 feet. The subsoil is commonly 6 to 10 inches thick. In many places, however, the subsoil is absent and the dark grayish-brown surface layer directly overlies the substratum. Severely eroded patches occur, and in those areas any tillage that takes place is in the uppermost 5 inches of the substratum. On some slopes 1 to 5 percent of the surface is covered by stones. In wooded areas a layer of leaves and leaf mold, about 2 inches thick, is on the surface. The surface layer consists of 1 to 2 inches of very dark grayish-brown silt loam that is underlain by about 7 inches of yellowish-brown channery silt loam.

This soil has moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is moderate to severe.

This soil is mainly in grass, shrubs, trees, or weeds. It is in wooded areas or in areas surrounding institutions, estates, and residential developments. If this soil is cultivated, the rotation should be a long one consisting of 1 year of a row crop, 1 year of a small grain, and 3 or 4 years of hay. The crops ought to be grown in contour strips, and diversion terraces should be constructed where needed. Areas where the slopes are steeper than 25 percent are best suited to perennial hay or pasture.

This soil has moderate to severe limitations for residential developments. (Capability unit IVe–3, woodland suitability group 3, community development group 5)

Manor very stony silt loam, 0 to 8 percent slopes (MnB).—This soil is on undulating hilltops and on nearly level to gently sloping ridges. In most places it has never been cultivated, and stones occupy 1 to 5 percent of the profile. The stones are generally flat, are 4 to 12 inches thick, and are 15 to 30 inches in diameter. In some places the pieces of gneiss are round and are 2 to 8 feet in diameter. The number of smaller pieces of rock is about the same, or slightly smaller, than in the profile described as typical for the series.

A layer of leaves and leaf mold, about 3 inches thick, is on the surface. Just beneath the leaves and leaf mold is a layer of very dark grayish-brown silt loam about 2 inches thick. This layer, in turn, overlies about 10 inches of very friable, dark yellowish-brown silt loam. In many places the substratum is less sandy than the one in the profile described as typical for the series.

Included with this soil in mapping are areas of Glenville soils in small, stony depressions and drainageways. In a

few places the subsoil is 1 to 3 feet thick and consists of a yellowish-brown to yellowish-red silty clay loam.

This soil is moderately permeable and has moderate to low available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Almost all of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, beech, red maple, and dogwood. The soil is well suited to trees and to wildlife habitats. Part of the acreage could be used for pasture if it were cleared and enough stones and channers were removed to permit the use of machinery.

Undesirable species and diseased trees should be removed to favor the oaks and tulip-poplars. White pine or Virginia pine should be planted in open areas and in thin stands.

In some places bedrock near the surface is a limitation to use of this soil for residential, light industrial, and institutional developments. Also, the elastic, unstable substratum may require special treatment where a development is planned. The degree of limitation for use as a tile field for disposing of the effluent from septic tanks must be determined at the site. This can be done by performing percolation tests and by determining the depth to bedrock. (Capability unit VIs–2, woodland suitability group 3, community development group 3)

Manor very stony silt loam, 8 to 25 percent slopes (MnD).—This soil is on hills and ridge slopes in the southern part of the county. It is similar to Manor very stony silt loam, 0 to 8 percent slopes, but it is steeper and contains more stones in most places. Bedrock crops out where there are abrupt changes in slope, and narrow escarpments are common.

Included with this soil in mapping are nonstony wooded areas and areas of Glenville soils in a few depressions and on toe slopes. In places the subsoil is redder and thicker than typical for the series.

This soil has moderately rapid permeability and has moderate to low available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, beech, hemlock, red maple, and dogwood. The less stony, less sloping areas can be used to a limited extent for pasture if they are cleared and if enough stones and channers are removed to permit the use of machinery. This soil is better suited to trees or to wildlife habitats, however, than to pasture. If it is used for timber, undesirable species, brush, and diseased trees ought to be removed to favor the oak and tulip-poplar. White or Virginia pine should be planted in open areas and in thin stands.

This soil has moderate to severe limitations for residential developments. (Capability unit VIs–2, woodland suitability group 3, community development group 5)

Mount Lucas Series

In the Mount Lucas series are deep, moderately well drained or somewhat poorly drained, nearly level to moderately sloping silt loams that have moderately slow permeability in the subsoil. These soils formed on dark igneous rocks, called diabase. They are on hilltops and ridges and on the lower toe slopes in the northern part of the county.

The Mount Lucas soils occur with the well-drained Neshaminy and poorly drained Watchung soils. Near them on the adjacent uplands are grayish colored Lehigh, Brecknock, and Croton soils.

In a typical profile of a Mount Lucas soil in wooded areas, the surface is covered with a thin layer of leaves and partly decayed organic matter. Beneath this layer is 2 inches of very friable, very dark brown silt loam that is underlain by about 7 inches of yellowish-brown, friable silt loam. Beneath the yellowish-brown silt loam is a layer of friable, brown silt loam or silty clay loam, about 4 inches thick, that grades to the material in the subsoil. About 15 percent of the surface layer consists of large, round stones that range from 1 foot to more than 12 feet in diameter.

The subsoil is about 2 feet thick. It is friable, brown clay loam that is mottled with grayish brown, red, and yellowish red. If the soil is disturbed, the subsoil readily breaks to many very small, smooth-surfaced blocks that can be crushed between the thumb and forefinger. The subsoil is sticky and plastic when wet.

The substratum is dark-brown to dark yellowish-brown sandy loam that is 2 to 5 feet thick and contains many small pieces of soft rock. Hard bedrock is at a depth of 5 to 10 feet.

These soils are moderately permeable to a depth of 10 to 15 inches. Permeability is moderately slow in the subsoil and variable in the substratum. The soils are slightly acid to nearly neutral. They have high available moisture capacity and high natural fertility. Their suitability for growing specific crops is variable.

Mount Lucas silt loam, 0 to 3 percent slopes (MoA).—This soil is on broad flats and in depressions at the base of slopes, and it is also on hilltops in the northern part of the county. Its profile is similar to the one described as typical for the series, but it contains only a few scattered stones. In most places the soil material to a depth of 8 to 10 inches has been mixed by plowing and consists of very dark grayish-brown silt loam. The subsoil is somewhat thicker than the surface layer. It ranges from 2 to 3 feet in thickness. Gray mottling is commonly at a depth of 15 to 24 inches. In some depressions the dark-colored surface layer is as thick as 18 inches.

Included with this soil in mapping are areas of poorly drained Watchung soils. These areas are too small to be mapped separately.

This Mount Lucas soil is slowly permeable and has a high water table within 1 foot of the surface during winter and early in spring. It is slow to dry out in spring. Where it occurs in depressions, it remains wet until early in summer. The hazard of erosion is slight, and surface runoff is slow. The available moisture capacity is high.

This soil is used for the commonly grown field crops, fruit, hay, pasture, and trees. It is fairly well suited to corn, spring-sown small grains, hay, and pasture, but alfalfa and winter grains are subject to winterkill. A suitable cropping system consists of 2 years of row crops and a cover crop, 1 year of a spring-sown small grain, and at least 1 year of grass-clover hay. Graded cultivation is needed to reduce erosion and to remove the excess

surface water. Tile drains help to remove the excess water in depressions and at the base of slopes.

This soil has moderate limitations for commercial, light industrial, institutional, and residential developments. The high water table, moderately slow permeability in the subsoil, and slow surface drainage are definite hazards if a development is planned. Limitations are severe to use of this soil as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 7, community development group 9)

Mount Lucas silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—This soil is on broad, undulating hilltops and ridges and near the foot of slopes in the northern part of the county. In a few areas, the surface layer is like the one in the profile described as typical for the series. In most places, however, the surface layer is dark grayish-brown silt loam that is 6 to 8 inches thick. It is as much as 15 inches thick in some places. The subsoil and substratum are like the ones in the profile described for the series, except that gray mottling occurs in the uppermost 10 inches of the subsoil. Only a few scattered stones are on the surface. Included with this soil in mapping are small areas of Watchung soils.

Permeability is moderately slow, and the water table is within a foot of the surface during winter and early in spring. The soil is slow to dry out in spring, and seeps at the foot of some slopes persist into early summer. Surface runoff is medium, and the hazard of erosion is moderate. The available moisture capacity is high.

This soil is used for the commonly grown field crops, fruit, hay, pasture, and trees. It is fairly well suited to corn, soybeans, spring grain, hay, and pasture, but it is fair to poor for fruit and vegetables. Alfalfa and winter small grains are likely to be injured by the high water table and frost heaving.

Using a suitable cropping system and planting the crops in field or graded strips will help to reduce losses from erosion, conserve moisture, and maintain good tilth. A suitable cropping system consists of 2 years of row crops and a cover crop, 1 year of a spring grain, and 2 years of grass-legume hay. On long slopes diversion terraces may be needed to remove excess surface water and to keep losses from erosion to a minimum. Random tile drains are effective in relieving wetness caused by seeps and springs.

This soil has moderate limitations to use for residential, light industrial, commercial, or institutional developments. It has severe limitations if it is used as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 7, community development group 9)

Mount Lucas silt loam, 8 to 15 percent slopes, moderately eroded (MoC2).—This soil is on hills and ridges, especially on benches near the foot of slopes. The surface layer is dark grayish-brown or dark-brown silt loam 6 to 8 inches thick. The subsoil and substratum are slightly thinner than those in the profile described as typical for the series.

In some places this soil is shallower over the substratum and is more sandy throughout than the one for which a profile is described as typical for the series. Grayish-brown mottling commonly occurs at a depth of 24 to 30 inches, but it is at a depth of only 15 inches in some places. Most areas of this soil contain only a few scattered stones, but small areas that are very stony have been included where they could not be mapped separately. This soil contains more small pieces of rock and is grayer than normal where it adjoins areas of Lehigh soils. Small areas of Neshaminy soils are included with it in mapping.

Permeability is moderately slow, and the water table is only 1 to 1½ feet below the surface during winter and early in spring. This soil dries slowly, and seeps at the foot of some slopes persist until early in summer. Surface runoff is medium to rapid, and there is a moderate to severe hazard of erosion. The available moisture capacity is high.

This soil is used for fruit, hay, and pasture, and it is used, to a small extent, for general field crops. It is fair for corn, spring-sown small grains, and fruit, but winter small grains and alfalfa are likely to be damaged by frost heaving and the high water table. The crops ought to be planted in graded strips, and a suitable cropping system should be used. A suitable cropping system is 1 year of a row crop and a cover crop, 1 year of a spring-sown small grain, and 2 years of grass-legume hay. All crop residue ought to be returned to the soil. Tile drains can be used to drain the areas where moisture is excessive because of seeps and springs.

This soil has moderate limitations as a site for residential, light industrial, institutional, or commercial developments. It has severe limitations if used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–6, woodland suitability group 7, community development group 10)

Mount Lucas very stony silt loam, 0 to 8 percent slopes (MuB).—This soil is on undulating hilltops and ridges and on low-lying flats in the northern part of the county. It is less steep than the one for which a profile is described as typical for the series, and its subsoil is somewhat thicker, or 2 to 3 feet thick. In a few areas the uppermost 8 to 10 inches has been mixed by plowing. The stones in the surface layer range from 1 to 12 feet or more in diameter (fig. 25). Included with this soil in mapping are small areas of Watchung soils.

Permeability is moderately slow, and the water table is within 1 foot of the surface during winter and early in spring. Where this soil is in depressions, near springs, and in seepage areas, it remains wet until early in summer.

Figure 25.—**Typical field of Mount Lucas very stony silt loam, 0 to 8 percent slopes, that has large stones on the surface.**

Surface drainage is slow, and the hazard of erosion is slight. The available moisture capacity is high.

Most of the acreage is in wooded areas, but a small acreage is used for pasture or orchards. The woodland consists of mixed oaks, hickory, tulip-poplar, ash, and dogwood. This soil is well suited to trees and is fair for pasture. Where it is used for pasture, removing the stones is not practical. Light farm machinery can sometimes be used, however, for planting, liming, and fertilizing.

This soil is well suited to reed canarygrass, birdsfoot trefoil, Kentucky bluegrass, and ladino clover. The areas in trees should be protected from fire and grazing, and oak and poplar need to be encouraged by selective cutting. Open areas or areas where the stand is thin can be replanted with white or Austrian pine. (Capability unit VIs–1, woodland suitability group 7, community development group 9)

Mount Lucas very stony silt loam, 8 to 25 percent slopes (MuD).—This soil is on hills and on the lower ridge slopes in the northern part of the county. Its profile is the one described as typical for the series. In a few places, however, the profile is shallower over the substratum and is more sandy throughout than the one described.

In a few areas, the uppermost 8 to 10 inches of soil material has been mixed by plowing. The stones range from 1 foot to more than 12 feet in diameter. They are either rounded or have broad, flat tops, and they are so numerous in places that there is only a little soil material between them.

Included with this soil in mapping are small areas of Neshaminy soils that are free of mottling to a depth of more than 3 feet. Also included are areas of moderately sloping Watchung soils that are grayer or are mottled closer to the surface than this soil.

Permeability is moderately slow, and the water table is within 1 foot of the surface during winter and early in spring. Seeps and springs develop early in winter and sometimes persist until July. Surface runoff is medium or slow, and the hazard of erosion is slight. The available moisture capacity is high.

This soil is mainly in wooded areas consisting primarily of mixed oaks, hickory, tulip-poplar, ash, and dogwood. It is well suited to forest trees, but the moderately sloping, less stony areas are fair for pasture and fruit. This soil is also well suited to bluegrass, ladino clover, birdsfoot trefoil, and reed canarygrass. Removing the stones is generally not practical, but light machinery can at times be used for disking, planting, liming, and fertilizing. The oak and tulip-poplar need to be favored through selective cutting. Open areas and areas where the stand is thin can be planted to white pine or Austrian pine. (Capability unit VIs–1, woodland suitability group 7, community development group 10)

Murrill Series

The Murrill series consists of deep, well-drained gravelly silt loams. These soils formed in material weathered from quartzite. Many years ago this material slid or washed off hills and ridges and accumulated at the base of the slopes, where it covered the limestone material on the valley floor.

These soils are on benches that extend along the edges of the limestone valley in the south-central part of the county. They contain more gravel and are less silty than the Lawrenceville soils, and they are coarser textured than the Duffield soils. The Murrill soils are deeper and finer textured than the Lansdale and Edgemont soils.

In a typical profile of a Murrill soil, the surface layer is very friable, very dark grayish-brown gravelly silt loam or loam about 9 inches thick. Small pieces of quartzite and schist make up 20 to 35 percent of the soil material.

The uppermost 18 to 24 inches of the subsoil is friable, dark-brown channery loam, but 15 to 35 percent of it consists of fragments of rock. The lower part of the subsoil is mainly firm, yellowish-red clay loam, but 15 to 20 percent of it is fragments of rock. The subsoil is more sandy and channery with increasing depth. Limestone bedrock is 8 to 15 feet below the surface.

Permeability is moderate, and the available moisture capacity is high. The soils are medium acid to slightly acid and have high natural fertility. These soils are well suited to most of the crops commonly grown in the county. They have few limitations for developments.

Murrill gravelly silt loam, 3 to 10 percent slopes, moderately eroded (MvB2).—This is the only soil of the Murrill series mapped in this county. It has the profile described as typical for the series. This soil is on narrow benches and toe slopes on the edges of the limestone valley in the south-central part of the county. The areas are generally small and widely scattered, but two large areas are near Valley Forge State Park and Fort Washington State Park.

In depressions and on low-lying flats, areas of Lawrenceville soils occur with this soil. Adjoining this soil on low uplands are areas of the Duffield soils. On the adjacent higher hills and ridges are areas of the Penn, Lansdale, Edgemont, and Manor soils.

Included with this soil in mapping are a few areas that are more silty and shaly than normal for this soil and that contain no fragments of quartzite. In some places the lower part of the subsoil has a texture of silt loam and a color between yellowish brown and red. In places this soil has a channery surface layer. In a few pockets and bands, gray mottling occurs in the lower part of the subsoil below a depth of 30 inches.

Permeability is moderate, and the available moisture capacity is high. Surface runoff is slow to medium, and there is a slight to moderate hazard of erosion.

This soil is mainly used for lawns, trees, and shrubs. It is mostly in parks, golf courses, and estates and in areas surrounding residential developments. A small acreage is used for the commonly grown field crops, hay, pasture, and nursery stock. The crops grown on this soil respond well to moderate applications of lime and fertilizer. This soil is well suited to a number of kinds of field crops and to vegetables, nursery stock, hay, and pasture. If it is farmed, it should be planted in field or contour strips. A cropping system no more intensive than 2 years of row crops followed by a cover crop the first year, 1 year of a winter small grain, and at least 1 year of grass-legume hay is suitable. Crop residue should be incorporated in the soil.

This soil has few limitations for use in residential, light industrial, commercial, or institutional develop-

ments. The possibility of solution channels in the limestone bedrock should be carefully investigated, however, before a heavy structure is installed. Limitations are slight for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Neshaminy Series

The Neshaminy series consists of deep, well-drained soils formed in material weathered from dark igneous rocks, called diabase. These soils are gently sloping to steep and are on hills and ridges in the northern part of the county.

The Neshaminy soils are adjacent to moderately well drained or somewhat poorly drained Mount Lucas soils and poorly drained Watchung soils. Near them are gray Lehigh and Becknock soils and reddish-brown Penn soils.

In a typical profile of a Neshaminy soil, the plow layer is friable, dark reddish-brown silt loam about 6 inches thick. Below the plow layer is a layer, about 2 inches thick, of friable, yellowish-red clay loam that grades to the subsoil.

The subsoil is 2 to 3 feet thick. It is friable, yellowish-red clay loam that is somewhat sticky and plastic when wet. If the soil is disturbed, the subsoil breaks to many small, smooth-surfaced blocks that can be broken between the thumb and forefinger. From 10 to 20 percent of the subsoil consists of small pieces of rock. The lower part contains more sand and fragments of rock than the upper part, and it grades to the substratum.

The substratum is 1 to 3 feet thick. It is yellowish-red sandy clay loam and dark-brown sandy loam. About 30 percent of it consists of small pieces of rock. Depth to bedrock is generally about 4 feet, but the range is from 3 to 6 feet.

These soils are slightly acid to neutral and have high natural fertility. Permeability is moderate, and the available moisture capacity is high. The soils are productive, but they vary in suitability for growing specific crops. They have certain limitations to use for developments.

Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded (NhB2).—This soil is less sloping than the one for which a profile is described as typical for the series. Also, it has a surface layer that is 8 to 10 inches thick and a subsoil that is 2 to 3½ feet thick. In places on the lower slopes, the surface layer is 12 to 14 inches thick. This soil is on broad, undulating hilltops and ridges in the northern part of the county.

Included with this soil in mapping are small areas that are nearly level. Also, a few lighter colored patches occur where erosion has removed nearly all of the original surface layer and plowing is in the upper part of the subsoil. In some areas patches of Legore soils that are shallower and more sandy than this soil are included.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate. This soil has high natural fertility.

This soil is used for the commonly grown field crops, fruit, hay, and pasture. It is well suited to corn, small grains, apples, peaches, alfalfa, orchardgrass, ladino clover, and bluegrass. The crops ought to be planted in field or contour strips and a cropping system used that consists of 2 years of row crops, 1 year of a winter small grain, and at least 1 year of grass-legume hay. A cover crop is needed following the first year of row crops. The crop residue ought to be conserved and incorporated into the soil. The crops respond well to small or moderate applications of lime and fertilizer.

This soil has slight limitations for residential, light industrial, commercial, or institutional developments. It has moderate limitations as a disposal field for the effluent from septic tanks, unless percolation tests made at the specific site are favorable. Where this soil is disturbed, it is unstable, erodible, and subject to damage from frost action. (Capability unit IIe–1, woodland suitability group 2, community development group 1)

Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded (NhC2). This soil has the profile described as typical for the series. It is on hills and ridges in the northern part of the county.

Included with this soil in mapping are small areas, generally near the foot of slopes, that have a dark-colored surface layer 10 to 12 inches thick. A few gullied areas are included. Also, there are many small, light-colored patches where all or nearly all of the original surface layer has been lost through erosion and cultivation is now in the upper part of the subsoil. In many places occasional large, rounded stones occur, but they generally make up less than 1 percent of the surface layer.

This soil is moderately permeable and has high available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe. Natural fertility is high.

This soil is used for general field crops, fruit, hay, and pasture. Also, part of the acreage is idle and is overgrown with weeds and brush. The soil is well suited to corn, winter small grains, apples, peaches, alfalfa, and orchardgrass. Field or contour stripcropping should be practiced. A suitable cropping system consists of 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of hay or deep-rooted grasses and legumes. The crops respond well to moderate applications of lime and fertilizer. On long slopes diversion terraces with grassed waterways further reduce losses from erosion and safely carry away excess surface water.

This soil has moderate limitations for residential developments. It also has moderate limitations for use as a disposal field for the effluent from septic tanks, unless percolation tests made at the specific site prove it to be favorable for that use. Where this soil is disturbed by earthmoving operations, it is subject to severe erosion, damage from frost action, and soil creep. (Capability unit IIIe–1, woodland suitability group 2, community development group 2)

Neshaminy silt loam, 15 to 25 percent slopes, moderately eroded (NhD2).—This soil is steeper than the one for which a profile is described as typical for the series, and its plow layer consists of material from the subsoil mixed with the original surface soil. The subsoil is 1½ to 2 feet thick. This soil is in scattered, small areas on hillsides and ridge slopes in the northern part of the county.

Areas in which the slopes are short and are steeper than 25 percent are included with this soil in mapping. Occassional large stones occur, and bedrock crops out in places

near the crests of slopes. Patches of yellowish-red clay loam and sandy clay loam are common, especially on mid slopes and near actively eroding gullies. In some places small bands of Mount Lucas soils are included near the bottom of slopes.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe. Natural fertility is high.

This soil is used for fruit and pasture and, to a lesser extent, for corn and small grains. Much of the acreage is idle and is overgrown with young trees, weeds, honeysuckle, and poison-ivy. This soil is fair for corn, winter small grains, apples, and peaches. If it is used for cultivated crops, field or contour stripcropping is needed with a cropping system consisting of 1 year of a row crop, 1 year of a small grain, and at least 4 years of deep-rooted grasses and legumes grown for hay. The crops respond well to moderate or large applications of fertilizer. Requirements for lime are generally light to moderate. Crop residue should be conserved and incorporated into the soil. On the long slopes, diversion terraces will reduce damage caused by excessive runoff.

This soil has moderate to severe limitations for residential developments. (Capability unit IVe–1, woodland suitability group 2, community development group 5)

Neshaminy very stony silt loam, 0 to 8 percent slopes (NsB).—This soil has a 3-inch layer of leaves and black leaf mold on its surface. Beneath this layer is about 2 inches of very dark brown very stony silt loam underlain by a layer of friable, yellowish-brown very stony silt loam 6 to 9 inches thick. The subsoil consists of 24 to 40 inches of strong-brown or yellowish-red very stony clay loam. The subsoil is firm in place, but it readily breaks to small blocks if it is disturbed. The substratum ranges from a sandy rind only an inch or so thick over bedrock to a gravelly mass of stony sandy clay loam or sandy loam 1 to 3 feet thick. The stones are rounded and range from 1 foot to more than 12 feet in diameter. They occupy 1 to 6 percent of the surface. This soil is on hilltops, ridges, and midslope benches in the northern part of the county.

In a few places brown or grayish-brown streaks are at a depth of 30 inches or more. Some fields that are now cultivated or that have been cultivated in the past have a plow layer like the one in the profile described as typical for the series. Small areas, especially on ridgetops, are extremely stony or consist entirely of rounded and flat-topped stones and boulders.

Included with this soil in mapping are areas of Mount Lucas soils. These areas are too small to be mapped separately.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Most of this soil is in wooded areas, and the trees are mainly mixed oaks, tulip-poplar, beech, ash, sweet birch, red maple, and dogwood. A few areas are used for pasture and orchards. The soil is well suited to forest trees and is fair for pastures and fruit. Removing the stones and boulders is not practical, but light farm machinery can be used in some areas for planting, liming, and fertilizing. The soil is well suited to Kentucky bluegrass, tall fescue, reed canarygrass, ladino clover, and birdsfoot trefoil. Oak and tulip-poplar should be encouraged by selective cutting. White or Austrian pine ought to be replanted in open areas and in areas where the stand is thin. (Capability unit VIs–1, woodland suitability group 2, community development group 1)

Neshaminy very stony silt loam, 8 to 25 percent slopes (NsD).—In a few areas, this soil has a surface layer like the one described as typical for the series. In most places, however, this soil is similar to Neshaminy very stony silt loam, 0 to 8 percent slopes, except that it is moderately sloping to moderately steep and has a slightly thinner subsoil that ranges from 20 to 36 inches in thickness. It is on hills and ridge slopes in the northern part of the county. In many places this soil occurs above or below the less sloping Mount Lucas soils.

Some areas of this soil are more sandy and are shallower over bedrock than the soil for which a profile is described as typical for the series. Included in mapping are small areas that are extremely stony. Also included are areas of Mount Lucas soils in depressions and drainageways, and on the lower toe slopes. These included areas are too small to be mapped separately.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most of the acreage is in wooded areas consisting of mixed oaks, hickory, tulip-poplar, beech, sweet birch, and dogwood. A few areas are used for pasture and orchards. This soil is well suited to use as woodland, but the moderately sloping, less stony areas are fair for pasture or orchards. The soil is well suited to bluegrass, ladino clover, birdsfoot trefoil, and reed canarygrass. Removing the stones and boulders is not practical, but light machinery can be used in some areas for plowing, planting, fertilizing, and liming.

White pine or Austrian pine ought to be used to replant areas that are now open or that have a thin stand. This soil is well suited to parks, natural recreational areas, and wildlife habitats. (Capability unit VIs–1, woodland suitability group 2, community development group 5)

Neshaminy extremely stony silt loam, 0 to 8 percent slopes (NeB).—This soil is on hilltops and ridges. It is so stony that a person can usually step or jump from stone to stone without touching the surface of the soil (fig. 26). The stones and boulders are rounded, but some of them have broad, flat tops, and they range from about 1 foot to more than 12 feet in diameter. Except for the stones, the profile of this soil is like that of Neshaminy very stony silt loam, 0 to 8 percent slopes.

Included with this soil in mapping are small areas where bedrock crops out. Also, scattered throughout the areas are nonstony patches that are too small to be mapped separately. Other inclusions consist of extremely stony Mount Lucas soils in depressions and on flats.

This Neshaminy soil is moderately permeable and has high available moisture capacity. Surface runoff is slow, and the hazard of erosion is slight.

Some small areas of this soil were formerly cleared and used for pasture, but now all of the acreage is in wooded areas consisting of mixed oaks, tulip-poplar, hickory, beech, and dogwood. This soil is better suited to trees than to field crops or pasture. Selective and improvement cutting to remove unwanted species and the stunted

Figure 26.—Neshaminy extremely stony silt loam, 0 to 8 percent slopes, in a wooded area.

and diseased trees will encourage oak and poplar. White pine or Austrian pine ought to be planted in open areas or in areas where the stand is thin. (Capability unit VIIs-1, woodland suitability group 2, community development group 8)

Penn Series

In the Penn series are moderately deep to shallow, reddish-brown silt loams formed in material weathered from red shale, siltstone, and fine-grained sandstone. These soils are important for agriculture and are widely distributed throughout the northern two-thirds of the county (fig. 27).

The Penn soils occur on undulating and hilly uplands adjacent to the Lansdale, Reaville, Readington, Abbottstown, and Croton soils. In many places they are also adjacent to gray Lehigh and Brecknock soils and to the Neshaminy soils, which are finer textured than these soils. The Penn soils are redder and less sandy than the Lansdale soils. Their profile resembles that of the Reaville soils, but it does not have a gray, mottled layer just above the substratum. They are not so deep as the moderately well drained Readington soils, and they contain more shale than those soils. The Penn soils are shallower and do not have the gray, mottled subsoil that is typical of the somewhat poorly drained Abbottstown and poorly drained Croton soils.

Figure 27.—A field of Penn soils in the northern part of the county. The wooded ridge in the background is occupied by Neshaminy soils that are underlain by diabase.

In a typical profile of a Penn soil, the surface layer is friable, dark reddish-brown silt loam about 8 inches thick. About 10 percent of the surface layer is shale.

The subsoil is reddish-brown shaly silt loam about 12 inches thick. Shale makes up 5 to 20 percent of the upper part. The content of shale increases to about 30 to 60 percent, however, where the subsoil grades to the substratum.

The substratum is a weak-red layer about 10 to 12 inches thick. It consists of broken pieces of shale with a small amount of loam or silt loam between the pieces. The material in the substratum grades to firm shale at a depth of about 30 to 36 inches. Dusky-red to reddish-brown shale, siltstone, or fine-grained sandstone bedrock is 2 to 3 feet below the surface.

These soils have moderately rapid permeability and low to moderate available moisture capacity. They have a slightly acid to strongly acid substratum. Large applications of lime, however, have made the plow layer and the subsoil medium acid to neutral. Natural fertility is moderate to low.

These soils are used for fruit, vegetables, commonly grown field crops, hay, and pasture. The crops usually respond well to moderate, frequent applications of lime and fertilizer. The soils have limitations for residential developments.

Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, moderately eroded (PaB2).—This soil has a surface layer of dark reddish-brown silt loam. The surface layer is 8 to 10 inches thick, and 10 to 25 percent of it is shale. The subsoil is 10 to 15 inches thick and is underlain by a substratum of very shaly silt loam. The substratum is slightly acid or neutral in most places. The unweathered, freshly broken shale effervesces if it is treated with dilute hydrochloric acid. In general, depth to bedrock is between 2 and 3 feet, but in a few places bedrock is at a depth of only 12 inches. This soil is on rolling uplands in the northern third of the county.

Near Niantic, less shaly areas in which the substratum is at a depth of about 30 inches were included with this soil in mapping.

This soil has moderately rapid permeability and low to moderate available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate to severe.

This soil is used for fruit, commonly grown field crops, hay, and pasture. It is well suited to hay and pasture consisting of drought-resistant grasses and legumes, and it is suited to alfalfa grown for a short period. This soil is only fair for corn, fruit, and winter small grains. The areas of this soil near Niantic are more suitable for growing fruit than are other parts of the county. Yields of field crops and fruit are moderate in years of normal rainfall, but they are severely reduced in dry years.

In most places moderate, frequent applications of lime and fertilizer are adequate for crops grown on this soil. Either field or contour stripcropping is needed, and a cropping system no more intensive than 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume

hay is suitable. Crop residue should be incorporated into the soil.

This soil is suitable for residential, industrial, commercial, and institutional developments if adequate facilities for treating and disposing of sewage are available. It varies in suitability for use as a disposal field for the effluent from septic tanks. This soil is well suited to grass, trees, and shrubs in parks and estates and surrounding institutions and residential developments. (Capability unit IIIe–5, woodland suitability group 4, community development group 3)

Penn shaly silt loam, neutral substratum, 3 to 8 percent slopes, severely eroded (PaB3).—This soil occurs with the Reaville and Klinesvillle soils on rolling uplands and hilltops in the northern third of the county. The surface layer is reddish-brown shaly silt loam, 7 inches thick, and 20 to 30 percent of it is shale. The subsoil is about 11 inches thick, and 20 to 50 percent of it is shale. The substratum grades to shale bedrock at a depth of 24 to 32 inches. The substratum is neutral or slightly acid, and pieces of the freshly broken bedrock effervesce when dilute hydrochloric acid is added.

Included with this soil in mapping are areas in which the soil is only 6 to 12 inches deep over bedrock. Also included are areas in which the substratum is very shaly. In a few places, the substratum is only slightly acid. Very shaly streaks and ridges occur in this soil, as well as occasional outcroppings of weathered shale bedrock.

This soil is rapidly permeable and has low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, fruit, hay, and pasture. It is well suited to perennial hay and pasture consisting of drought-resistant grasses and legumes, but corn, fruit, and small grains are generally not profitable. Moderate to small, frequent applications of lime and fertilizer are needed. Also, where facilities are available, supplemental irrigation helps to maintain fair yields and forage of fair quality.

If this soil is cultivated, a long rotation consisting of 1 year of a row crop, 1 year of a small grain, and 3 or more years of hay is suitable. When necessary for highest production, hayfields and pastures ought to be reseeded in alternate field and contour strips. Half the strips should be planted the first year and the rest the following year. Pastures should be rotated to prevent overgrazing.

This soil has severe limitations for residential, light industrial, commercial, and institutional developments. Shale and shallow bedrock make grading and excavating difficult. This soil also has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 6)

Penn shaly silt loam, neutral substratum, 8 to 15 percent slopes, severely eroded (PaC3).—This soil is steeper and shallower than the one for which a profile is described as typical for the series. The surface layer is 4 to 6 inches thick, and 20 to 50 percent of it is shale. The subsoil is 6 to 12 inches thick, and it is underlain by bedrock or by the thin, very shaly substratum. This soil is on rolling and hilly uplands in the northern third of the county.

In this mapping unit are areas near Niantic that are deeper and less eroded than typical for this soil. In other places bedrock is only 6 inches beneath the surface, and it crops out on the surface in a few bands near the tops of ridges. Patches where the surface layer is very shaly and where tillage is in the substratum are also included. In some places the reaction is medium acid to neutral. Pieces of the raw, freshly broken bedrock effervesce when dilute hydrochloric acid is added.

This soil has moderately rapid permeability and low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is better suited to pasture or wooded areas than to field crops or fruit. It is used, however, for fruit, commonly grown field crops, hay, and pasture. Nevertheless, this soil generally is poorly suited to corn, fruit, small grains, and hay. It is suited to birdsfoot trefoil and reed-canarygrass, which tolerate drought.

Plantings for a new pasture or for renovating a pasture should be made in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures ought to be rotated so that overgrazing will be prevented, especially during summer. White pine or Virginia pine could be planted on the short slopes and in areas not needed for pasture.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. It also has severe limitations for use as a disposal field for the effluent from septic tanks. Shale and bedrock near the surface make grading and excavating difficult. (Capability unit VIe–1, woodland suitability group 4, community development group 7)

Penn silt loam, 0 to 3 percent slopes, moderately eroded (PeA2).—This soil is less sloping than the soil for which a profile is described as typical for the series. In most places it also has a thicker subsoil and contains fewer pieces of shale. The substratum in most areas is at a depth of 18 to 30 inches, but it is as shallow as 12 inches in some places and as deep as 36 inches in others. This soil is on smooth or undulating uplands in the northern two-thirds of the county.

Included with this soil in mapping are areas in which the soil is only slightly eroded or that have accumulated soil material on the surface. Also included are small areas of Readington soils. In some narrow ridges and bands, the soil material is shallower and contains more fragments of shale than normal for this soil. Depth to bedrock ranges from 12 inches to 5 feet.

This soil is moderately permeable and has low to moderate available moisture capacity. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for vegetables, commonly grown field crops, hay, and pasture. Part of it is in grass or trees in golf courses and estates and surrounding industries, residences, and institutions. The soil is fair for corn, vegetables, and alfalfa, and it is well suited to winter small grains and to hay and pasture. The crops respond well to moderate applications of lime and fertilizer. Supplemental irrigation will increase the yields and improve the quality of the crops.

If this soil is farmed across the slope, a suitable cropping system consists of 2 years of row crops, 1 year of a small grain, and at least 1 year of grass-legume hay. Usually, a cropping system consisting of a row crop and a small grain grown in rotation is also adequate for protection if the soil is cultivated on the contour. A

cover crop ought to be grown when the soil would otherwise be unprotected during winter. Also, crop residue should be incorporated into the soil.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. It has moderate to severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be conducted at the specific site. (Capability unit IIs–1, woodland suitability group 4, community development group 3)

Penn silt loam, 3 to 8 percent slopes, moderately eroded (PeB2).—This soil is on undulating uplands and hilltops in the northern two-thirds of the county. In most places its profile is the one described as typical for the series. In a few areas, however, this soil has not been cultivated. In those areas it has a layer of leaves and organic matter and a layer of very dark brown silt loam, about 2 inches thick, overlying the described surface layer.

Included with this soil in mapping are slightly eroded areas in which the surface layer is thicker and less shaly than that in the profile described. Also included are small shaly and channery areas. In a few places the reaction in the substratum is medium acid to neutral.

Permeability is moderately rapid, and this soil has low available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate. This soil is used for fruit, vegetables, commonly grown field crops, hay, and pasture. Also, part of it is in golf courses and estates and surrounding industries, residences, and institutions. This soil is fair for corn, vegetables, apples, peaches, and alfalfa, and it is well suited to winter grains, hay, and pasture. Yields are moderate in years of normal rainfall, but they are severely reduced in dry years. Moderate, frequent applications of lime and fertilizer are usually needed. Supplemental irrigation, where available, helps to maintain good yields and the quality of the crop. A cropping system consisting of 1 year of a row crop, 1 year of a winter small grain, and 2 or 3 years of grass-legume hay is suitable. The crops should be planted in field or contour strips, and the crop residue ought to be conserved and incorporated into the soil. Diversion terraces and grassed waterways may be needed on the long slopes to safely carry off the surface water.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests should be conducted at the specific site. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Penn silt loam, 3 to 8 percent slopes, severely eroded (PeB3).—This soil is less deep than the one for which a profile is described as typical for the series. Also, the surface layer contains more shale, is only 6 to 8 inches thick, and consists largely of material from the subsoil mixed with organic matter. The substratum is 12 to 24 inches below the surface. This gently sloping soil is on undulating uplands and hilltops in the northern two-thirds of the county.

Included with this soil in mapping are areas in which the shaly substratum is at the surface, and there are occasional outcroppings of bedrock. Small areas of Reaville and Readington soils are also included. In some places the substratum is medium acid to neutral.

Permeability is moderately rapid, and the available moisture capacity is low. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops and for hay and pasture. Part of the acreage is in grass, weeds, and brush on estates and in areas surrounding residential developments. This soil is fairly well suited to hay and pasture consisting of drought-resistant plants. This soil is fair to poor for corn and winter small grains, and it is poor for alfalfa. Light, frequent applications of irrigation water help to maintain fair yields and the quality of the crop. A suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay. With this cropping system, the crop should be grown in field or contour strips. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways may be needed on the long slopes to control runoff.

This soil has moderate limitations for residential, light industrial, commercial, and institutional developments. Shale and bedrock near the surface make grading and excavating difficult. The soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–3, woodland suitability group 4, community development group 6)

Penn silt loam, 8 to 15 percent slopes, moderately eroded (PeC2).—This soil is steeper and shallower over the underlying material than the soil for which a profile in described as typical for the series. The surface layer is 6 to 8 inches thick, and 10 to 20 percent of it is shale. The subsoil is 8 to 20 inches thick, and bedrock is at a depth of 18 to 36 inches. This soil is on hills and on undulating uplands in the northern two-thirds of the county.

In wooded areas this soil has a layer of leaves and organic matter, about 2 inches thick, over about 2 inches of very dark brown silt loam. Beneath the very dark brown silt loam is about 6 inches of dark reddish-brown silt loam.

Included with this soil in mapping are small severely eroded and gullied areas where weathered shale bedrock crops out. Also included are areas of Readington and Reaville soils that have gray and black streaks and coatings just above the substratum. In a few areas, the substratum is slightly acid to neutral. Shaly and channery patches are common.

Permeability is moderately rapid, and this soil has low to moderate available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, orchards, hay, and pasture. Also, part of the acreage is in wooded areas or in grass on golf courses and estates and surrounding institutions, industries, and residential developments. This soil is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, orchardgrass, and other drought-resistant grasses and legumes. It is fair for corn and winter small grains, and it is fair to poor for fruit.

Crops grown on this soil respond well to moderate, frequent applications of lime and commercial fertilizer. Also, light, frequent applications of irrigation water help to maintain fair yields and good quality. The crops ought to be planted on the contour in a cropping system no more intensive than 1 year of a row crop, 1 year of a winter small grain, and at least 3 years of grass-legume

hay. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways help to control runoff on the long slopes.

This soil has moderate limitations for residential, commercial, light industrial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. However, percolation tests ought to be made at the specific site. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Penn silt loam, 8 to 15 percent slopes, severely eroded (PeC3).—This soil is on hills and undulating uplands in she northern two-thirds of the county. It is steeper, thallower, and more shaly than the one for which a profile is described as typical for the series. The surface layer is generally reddish-brown or weak-red silt loam that is only 4 to 6 inches thick, and 10 to 30 percent of it is shale. The subsoil is 8 to 24 inches thick. Bedrock is at a depth of 14 to 36 inches. Many gullies and rills are within areas of this soil.

In some places the surface layer is like the one in the profile described as typical for the series. In other places weathered shale bedrock crops out on the surface. The substratum in some areas is slightly acid or neutral. Included with this soil in mapping are small areas of Reaville soils in bands and pockets.

This Penn soil has moderately rapid permeability and low available moisture capacity. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, orchards, hay, and pasture. Much of the acreage, however, is in areas surrounding industries, estates, residences, and institutions and is overgrown with brush, grass, and weeds. This soil is suited to hay and pasture consisting of birdsfoot trefoil, reed canarygrass, and other drought-resistant legumes and grasses. The growing of field crops and small grains is limited, however, by the droughty nature of this soil. Frequent, light applications of irrigation water help to maintain fair yields and the quality of the forage.

On this soil cultivated crops ought to be grown in a long rotation consisting of 3 or 4 years of hay followed by 1 year of a cultivated crop and 1 year of a winter small grain. When necessary, hayfields and pastures ought to be reseeded in alternate contour strips. Half the strips should be planted the first year and the rest the following year. The pastures need protection from overgrazing. Diversion terraces help to control erosion on the long slopes.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. The high content of shale and bedrock near the surface make grading and excavating difficult. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Penn very stony silt loam, 8 to 25 percent slopes (PfD).—This soil is on hills and on short, abrupt slopes adjacent to streams and drainageways in the northern two-thirds of the county. It is steeper than the soil for which a profile is described as typical for the series. Also, the surface layer is covered with 1 to 2 inches of leaf litter and partly decomposed organic matter over a layer, about 2 inches thick, of very dusky red very stony silt loam. Beneath the layer of very dusky red soil material is a layer, about 5 inches thick, of reddish-brown very stony silt loam. The stones occupy 1 to 5 percent of the surface and consist of large pieces of shale, siltstone, and sandstone that are 2 to 6 inches thick and 10 to 24 inches in diameter. In the areas near Ambler and south of Hatboro, the stones are sandstone and sandstone conglomerate. Near Niantic, they contain some limestone pebbles. In some places the surface layer is brown or yellowish brown.

Included with this soil in mapping are undulating areas on hilltops where the slope is less than 8 percent. In some areas the bedrock contains enough lime to effervesce when dilute hydrochloric acid is added. In the central part of the county, sandy areas are included with this soil.

Permeability is moderately rapid, and the available moisture capacity is low to moderate. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

Practically all of the acreage is in wooded areas consisting of ash, mixed oaks, beech, and dogwood. This soil can be used for pasture. It is necessary that it be cleared, however, and enough stones removed to permit the use of machinery for preparing the seedbed and seeding. Mowing of the pastures is generally not practical, but grazing ought to be rotated to prevent overgrazing. Brush and undesirable species need to be removed from the wooded areas. White or Virginia pine ought to be planted in open areas or in areas where the stand is thin.

This soil can be used for residential developments, but it has moderate limitations for that use. (Capability unit VIs–2, woodland suitability group 4, community development group 5)

Penn-Klinesville very shaly silt loams, 15 to 25 percent slopes, severely eroded (PkD3).—This soil complex consists of moderately steep Penn and Klinesville soils that occur together in such an intricate pattern it was not practical to separate them on the map. These soils are on hills and on short, abrupt slopes near streams and drainageways in the northern half of the county. Their profiles resemble the ones described as typical for the Penn and Klinesville series. They are shallower over bedrock, however, and they are more shaly. Their surface layer, especially, contains more shale.

In most places the surface layer is reddish-brown or dusky-red very shaly silt loam 4 to 6 inches thick. In places, however, the surface layer is dark reddish brown and is 6 to 8 inches thick. Hard shale bedrock crops out in a few places. In many places tillage is in the substratum of soft, broken shale. In a few areas, the shale contains enough lime to effervesce when dilute hydrochloric acid is added.

The soils of this complex have moderately rapid permeability and low available moisture capacity. Surface runoff is very rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops and for pasture. Also, part of the acreage is in grass, weeds, trees, or brush on golf courses and estates and surrounding institutions and other areas near residential developments. On farms these soils are well suited to pasture or trees. Birdsfoot trefoil, reed canarygrass, and other drought-resistant plants grow better than for-

age crops that do not resist drought. New plantings or seedings for renovation ought to be made in alternate contour strips, and half the strips should be planted the first year and the rest the following year. The pastures need protection from overgrazing. White pine and Virginia pine are suitable for woodland plantings.

The soils of this complex have severe limitations for commercial, light industrial, and institutional developments, and they have moderate to severe limitations for residential developments. They have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIe–1, woodland suitability group 11, community development group 5)

Penn-Lansdale loams, 3 to 8 percent slopes, moderately eroded (PlB2).—This complex consists of Penn and Lansdale soils that occur together on undulating uplands, hilltops, and ridges in the central part of the county. These soils are gently sloping. They have profiles similar to the ones described as typical for the Penn and the Lansdale series, but the Penn soil has slightly more sand throughout the profile.

Included with these soils in mapping are areas underlain by red and brown shale. In those areas the profile of the Lansdale soil is more silty and shaly than the one described as typical for the series. Also included are nearly level areas on narrow hilltops and ridges.

The soils of this complex have moderate or moderately rapid permeability. The Penn soil has low to moderate available moisture capacity, and the Lansdale soil has high available moisture capacity. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used for fruit, vegetables, nursery stock, commonly grown field crops, hay, and pasture. Part of the acreage is in grass and trees on golf courses and estates and in areas surrounding residential developments. The soils are well suited to winter small grains, nursery stock, and most grasses and legumes. They are fair for apples, peaches, corn, vegetables, and alfalfa. Yields are severely reduced in dry years. Field or contour stripcropping is needed in most fields. With the field or contour stripcropping, a suitable cropping system is 1 year of a row crop, 1 year of a winter small grain, and 2 years or more of grass-legume hay. The crop residue should be conserved and incorporated into the soils. Crops grown on these soils respond well to moderate, frequent applications of lime and fertilizer. Supplemental irrigation increases yields and improves the quality of the crop during dry seasons. Diversion terraces and grassed waterways may be needed on long slopes to safely carry away surplus runoff.

This complex has moderate limitations for residential, light industrial, commercial, and institutional developments. Bedrock near the surface is a limitation to use as a disposal field for the effluent from septic tanks. Depth to bedrock ought to be determined and percolation tests should be made at the specific site. (Capability unit IIe–3, woodland suitability group 4, community development group 3)

Penn-Lansdale loams, 3 to 8 percent slopes, severely eroded (PlB3).—This complex consists of Penn and Lansdale soils that occur together on undulating uplands, hilltops, and ridges in the central part of the county. The profiles of these soils are similar to the ones described as typical for the Penn and Lansdale series. They have a thinner surface layer and subsoil and contain more shale and pieces of sandstone. Also, in most places they are more sandy. The soils are generally underlain by interbedded red shale or fine-grained sandstone and by light-brown or gray sandstone. In some areas, however, the bedrock consists of red and brown shale. In these areas the Lansdale soil is more silty and shaly than typical for the series. In a few places, bedrock crops out on the surface. In many places shallow gullies and rills penetrate the substratum.

Permeability is moderate to moderately rapid, and the available moisture capacity is low to moderate. Surface runoff is rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, fruit, nursery stock, hay, and pasture. Also, a large acreage is in grass, trees, shrubs, or weeds in estates and in areas surrounding residential, industrial, and other developments. These soils are suited to hay or pasture consisting of drought-resistant grasses and legumes. They are fair for corn, winter small grains, and alfalfa. If these soils are cropped, field or contour stripcropping is needed and a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 3 years of grass-legume hay. Manure and crop residue should be incorporated into the soil. Supplemental irrigation helps to maintain fair yields and the quality of the crop in dry seasons. Moderate, frequent applications are usually needed.

This complex has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–3, woodland suitability group 4, community development group 6)

Penn-Lansdale loams, 8 to 15 percent slopes, moderately eroded (PlC2).—This complex consists of Penn and Lansdale soils. These soils occur together in such a complex pattern it is not practical to separate them on the map. The soils are on hills and on short, abrupt slopes adjacent to streams and drainageways in the central part of the county. They have profiles similar to the ones described as typical for the Penn and Lansdale series, but they are steeper and contain more shale or pieces of sandstone. Also, their subsoil is thinner and bedrock is generally at a depth of 2 to 4 feet. The profile of the Penn soil is generally more sandy than the one described for the Penn series.

Included in this complex in mapping are areas of a Lansdale soil that is underlain by brown shale. This included soil has a subsoil of shaly silt loam.

The soils of this complex have moderate to moderately rapid permeability and moderate to low available moisture capacity. Surface runoff is medium to rapid, and the hazard of erosion is severe.

These soils are used for fruit, commonly grown field crops, hay, and pasture. Also, a large acreage is in golf courses and estates and surrounding institutions, residential, and industrial developments. The soils are fair for corn, apples, peaches, winter small grains, and alfalfa. They are also suitable for hay and pasture consisting of drought-resistant grasses and legumes. Contour stripcropping is needed, and a cropping system should be used that is no more intensive than 1 year of a row crop, 1 year of a winter small grain, and at least

3 years of grass-legume hay. Barnyard manure and crop residue ought to be incorporated into the soil. Diversion terraces and grassed waterways help to control runoff on the long slopes. Crops grown on these soils respond well to moderate, frequent applications of lime and fertilizer. Supplemental water supplied by irrigating will greatly increase the yields and quality of the crops that are grown during dry seasons.

The soils of this complex have moderate limitations for residential, commercial, light industrial, or institutional developments. Because of differences in depth to bedrock, the soils vary in suitability for use as a disposal field for the effluent from septic tanks. Depth to bedrock should be determined, and percolation tests ought to be made at the specific site. (Capability unit IIIe–3, woodland suitability group 4, community development group 4)

Penn-Lansdale loams, 8 to 15 percent slopes, severely eroded (PlC3).—This mapping unit consists of Penn and Lansdale soils that occur together on hills and on short, abrupt slopes. These soils are adjacent to streams and drainageways in the central part of the county. They are steeper and shallower and they contain more shale and fragments of sandstone than the soils for which profiles are described as typical for the Penn and Lansdale series. Also, these soils are generally more sandy than the soils for which profiles are described. Bedrock is mainly between a depth of 1½ and 3 feet, but in a few places it crops out on the surface. In many places tillage is in the substratum and gullies and rills have eroded down to hard rock.

The soils in this unit have moderate or moderately rapid permeability. The available water capacity is low to moderate. Surface runoff is rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, fruit, hay, and pasture. Also, a large acreage is in grass, weeds, and brush in areas surrounding developments and estates. Where these soils are cultivated, a cropping system no more intensive than 1 year of a row crop, 1 year of a small grain, and 4 years of hay is suitable. The soils are suitable for hay or pasture consisting of drought-resistant grasses and legumes, but they are poorly suited to general field crops, small grains, and fruit. The crops ought to be grown in contour strips, and the areas on long slopes need to be protected by diversion terraces. The hayfields and pastures should be reseeded in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures should be protected from overgrazing by rotating grazing. Light but frequent applications of irrigation water will increase the yield and the quality of the forage.

The soils of this mapping unit have moderate limitations for residential, light industrial, commercial, or institutional developments. Because of their variable depth to bedrock, they have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–3, woodland suitability group 4, community development group 7)

Penn-Lansdale loams, 15 to 25 percent slopes, severely eroded (PlD3).—This complex consists of Penn and Lansdale soils that occur together on hills and on short, abrupt slopes. These soils are adjacent to streams and drainageways in the central part of the county. They are steeper and much shallower than the soils for which profiles are described as typical for the Penn and Lansdale series, and they contain many more fragments of rock. The surface layer is only 4 to 5 inches thick. The substratum is shaly or sandy, and bedrock is at a depth of 12 to 36 inches. Tillage is in the substratum in many places. Outcrops of bedrock are common. In some places rills and gullies have eroded through the substratum down to hard bedrock.

Permeability is moderate to rapid, and the available moisture capacity is low to moderate. Surface runoff is very rapid, and the hazard of erosion is severe.

These soils are used for the commonly grown field crops, hay, and pasture. Also, much of the acreage is in grass, weeds, and brush in areas surrounding residential developments. These soils are suited to pasture or woodland, and drought-resistant grasses and legumes are suitable for forage.

New pasture plantings or seedings for renovation should be made in alternate contour strips. Half the strips ought to be planted the first year and the rest the following year. The pastures need protection from overgrazing.

The soils of this complex have severe limitations for commercial, light industrial, or institutional developments. They have moderate to severe limitations for residential developments. Because of the steep slopes and variable depth to bedrock, the soils have severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit VIe–1, woodland suitability group 4, community development group 5)

Raritan Series

This series consists of deep soils that are moderately well drained or somewhat poorly drained. These soils formed in old stream sediments washed from uplands underlain largely by red shale and sandstone. They are on upland flats, on benches, and in depressions along the Schuylkill River and the larger creeks in the northern two-thirds of the county.

The Raritan soils are less well drained than the Birdsboro soils that formed in similar material. They are less grayish than the poorly drained Croton soils on the adjacent uplands. The Raritan soils are at a higher elevation than the moderately well drained or somewhat poorly drained Rowland and poorly drained Bowmansville soils of the flood plains.

In a typical profile of a Raritan soil, the surface layer is very friable, dark-brown silt loam about 10 inches thick. It contains a few rounded pebbles. A layer of very friable, brown loam about 3 inches thick underlies the surface layer.

The uppermost 18 inches of the subsoil is friable, brown clay loam. Below this, the subsoil is firm and is mottled with reddish gray and grayish brown. This firm layer restricts the movement of water and the growth of roots. If the soil is disturbed, this layer readily breaks to small, angular blocks that can be crushed between the fingers. From 5 to 10 percent of it is gravel.

Below a depth of about 3 feet, the subsoil is very firm, reddish-brown silty clay loam mottled with gray. It

contains a few fragments of shale. Dusky-red shale bedrock is generally at a depth of about 5 feet, but the depth ranges from 4 to 15 feet.

These are strongly acid or medium acid, slowly permeable soils that have high available moisture capacity and moderate to low natural fertility. They are suited to the commonly grown field crops, spring-sown small grains, hay, and pasture. Limitations to developments are the slow permeability and the seasonal high water table.

Raritan silt loam, 0 to 3 percent slopes (RaA).—The profile of this soil is the one described as typical for the series. This soil is on low flats and in depressions above flood level along the Schuylkill River, West Swamp Creek, and Perkiomen Creek. The areas are small and scattered.

This soil has moderate and moderately slow permeability to a depth of 18 to 30 inches, but below that depth it is slowly permeable. Surface drainage is slow. The water table is only 12 to 24 inches beneath the surface during winter and early in spring. The available moisture capacity is high. The hazard of erosion is slight.

In many places along the Schuylkill River, this soil is overgrown with weeds and brush, but other areas are used largely for field crops, small grains, and hay. This soil is fairly well suited to corn, soybeans, spring-sown small grains, hay, and pasture. Generally, wetness makes it poorly suited to alfalfa and winter small grains.

Graded-row cultivation is suggested for this soil, and a suitable cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and 1 year of grass-legume hay of varieties that tolerate wetness. Tile drains help to remove the excess water in the soil.

This soil has moderate limitations if used for residential, light industrial, or commercial developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Raritan silt loam, 3 to 8 percent slopes, moderately eroded (RaB2).—This soil has a dark-brown surface layer about 8 inches thick. The subsoil is brown or reddish-brown silty clay loam or clay loam and is 24 to 36 inches thick. It has grayish mottles at a depth of 18 to 30 inches. This soil occurs in small patches that generally do not exceed 20 acres in size. It is on undulating uplands and rounded benches along the Schuylkill River, West Swamp Creek, and Perkiomen Creek.

In some places this soil consists of only 18 inches of terrace material over material weathered from bedrock. In a few places, the present surface layer consists almost entirely of material from the subsoil and of organic matter.

This soil has moderately slow permeability to a depth of 18 to 30 inches, and it is slowly permeable below that depth. Surface drainage is medium, and the hazard of erosion is moderate. The water table is within 18 to 30 inches of the surface during winter and early in spring. The available moisture capacity is high.

This soil is used for the commonly grown field crops, hay, and pasture. It is well suited to corn, soybeans, spring-sown small grains, ladino clover, timothy, and birdsfoot trefoil. Wetness causes alfalfa and winter grains to be subject to winterkill. Graded stripcropping is suggested. A suitable cropping system with graded stripcropping is 2 years of row crops and a cover crop for protection in fall and winter, 1 year of a spring-seeded small grain, and 2 years of grass-legume hay. Tile drains will help to remove the excess water from depressions and seeps.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It is severely limited for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Readington Series

In the Readington series are deep, moderately well drained silt loams that are nearly level to moderately sloping. These soils formed in material weathered from shale, siltstone, and sandstone. They are on smooth to rolling uplands in the northern two-thirds of the county. Their profile contains a firm subsoil that has grayish mottles in the lower part.

The Readington soils occur on uplands with the well drained, reddish-brown Penn soils, the well drained, brown Lansdale soils, and the moderately well drained, very silty Lawrenceville soils. Near them, on the lower slopes and flats, are the Chalfont, Abbottstown, and Croton soils. The Readington soils are less silty, contain more shale, and are not so gray as the Chalfont soils. Their profile resembles that of the Abbottstown soils, but they are less gray than those soils and have mottling lower in the subsoil. They generally contain less clay, have a browner surface layer, and lack the gray subsoil characteristic of the Croton soils.

In a typical profile of a Readington soil, the surface layer is friable, dark-brown silt loam about 8 inches thick. About 5 to 10 percent of the surface layer consists of fragments of shale. Below the surface layer is a layer of friable, brown silt loam about 3 inches thick.

The upper part of the subsoil is friable, brown to reddish-brown silt loam containing 5 to 15 percent shale fragments. At a depth of about 28 inches, the subsoil is very firm, reddish-brown silt loam or silty clay loam that is streaked and mottled with a grayish color in many places. When the subsoil is disturbed, it readily breaks to columns, called prisms, that are 4 to 6 inches in diameter and have a reddish-gray surface. These columns, in turn, break to small blocks and plates. From 15 to 30 percent of the subsoil is shale. The material in the subsoil grades to that in the substratum at a depth of about 3 feet.

The substratum is reddish-brown or weak-red shaly silt loam containing many grayish streaks and mottles. From 15 to 30 percent of it is fragments of shale. The amount of weak-red shale increases with increasing depth, and the shaly material grades to bedrock. Depth to bedrock is generally about 4 feet, but the depth ranges from 3 to 5 feet. Black coatings of iron and manganese are common on the surfaces of the peds and on the fragments of shale.

Permeability in the subsoil and substratum of these soils is moderately slow, and the available moisture capacity is moderate to high. These soils range from very strongly acid to medium acid and have moderate natural fertility. They are fairly well suited to corn, spring-sown small grains, and vegetables, and they are well suited to hay and pasture.

These soils can be used for residential developments, but they have moderate limitations for that use. The moderately slow permeability and the seasonal high water table are the major limitations.

Readington silt loam, 0 to 3 percent slopes (ReA).—This soil is in depressions and on flats on smooth or undulating uplands. The areas are large and scattered and occur throughout the northern two-thirds of the county. The profile of this soil is the one described as typical for the series.

In the area extending from Audubon through Norristown and Ambler to Hatboro, this soil is browner and more sandy than typical. Farther north, in a broad band that extends from Mont Clare in the west to Prospectville in the east, this soil is browner and more shaly than typical.

In areas of this soil in depressions, the surface layer is as much as 2 feet thick. In wooded areas leaf litter on the surface covers a layer of very dark brown silt loam about 2 inches thick. Beneath the very dark brown silt loam is a layer of friable, dark-brown or brown silt loam, about 8 inches thick.

Included with this soil in mapping are areas where erosion has removed as much as three-fourths of the original surface layer. Also included are a few areas where the soil is free of gray mottling but contains black concretions and has black coatings on the surface of the fragments of shale. In some small areas, grayish streaks and mottles are within 15 inches of the surface, although mottling is below a depth of 22 inches in most places.

Permeability is moderately rapid in the surface layer. It is moderately slow below a depth of 12 inches in the subsoil. Surface drainage is slow or very slow, and the water table is within 18 inches of the surface late in fall, in winter, and early in spring. This soil is slow to dry out in spring, but a seedbed can be prepared in most years in time for planting corn. Some areas in depressions and in seepage spots, however, remain wet well into the growing season. The available moisture capacity is high, but roots rarely reach all of the moisture available because of their restricted growth in the very firm subsoil. The hazard of erosion is slight.

This soil is used for the commonly grown field crops, fruit, vegetables, hay, and pasture. Also, a few areas are in golf courses and estates and surrounding institutions and residential and industrial developments. This soil is well suited to corn, soybeans, vegetables planted late in spring, spring-sown small grains, ladino clover, and orchardgrass. The high water table and frost heaving make alfalfa, winter grains, and fruit subject to some winter damage. Graded rows and cross-slope cultivation are needed. A suitable cropping system is no more intensive than 1 year of a row crop and a cover crop, 1 year of a spring-sown small grain, and 1 year of grass-legume hay. Row crops can be grown for 2 or 3 years in succession if they are planted in graded rows and if cross-slope cultivation is practiced.

The soil needs to be protected by a cover crop over winter, and crop residue ought to be incorporated into it. Tile drains help to relieve wetness in the depressions and seepage areas. Open drains also help to remove the excess surface water from the depressions.

This soil has moderate limitations for residential, light industrial, institutional, and commercial developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. The seasonal high water table, moderately slow permeability, and slow surface drainage are hazards to be considered if a development is planned. (Capability unit IIw–2, woodland suitability group 6, community development group 9)

Readington silt loam, 3 to 8 percent slopes, moderately eroded (ReB2).—This soil is shallower, has a thinner, more shaly surface layer, and is more sloping than the one for which a profile is described as typical for the series. In most places grayish mottling is 18 inches or more below the surface. This soil is on undulating uplands in the northern two-thirds of the county. The areas are widely distributed and occupy a large part of the acreage in that part of the county.

In the area extending from Audubon through Norristown and Ambler to Hatboro, this soil is browner and more sandy than typical. Farther north, in a broad belt extending from Mont Clare in the west to Prospectville in the east, this soil is also browner than typical and is more shaly throughout the profile. In a few small areas, mottling is at a depth of only 15 inches. A few areas are free of mottling to a depth of 36 inches or more, but they contain black concretions and have black coatings on the fragments of shale in the substratum.

In the central part of the county, areas are included in which the surface layer and the upper part of the subsoil are less shaly and more silty than typical. Scattered throughout areas of this soil are small patches in which the subsoil is more shaly or sandy than typical and the substratum, at a depth of 24 to 30 inches, is very shaly silt loam or channery sandy loam. In a few areas, bedrock is only 3 feet beneath the surface.

Permeability is moderately rapid to a depth of about 1 foot, but it is moderately slow below that depth. Surface runoff is medium in the less sloping areas, and there is a moderate hazard of erosion. On the long slopes of 6 to 8 percent, however, runoff is rapid and the hazard of erosion is severe. During winter and very early in spring, the water table is only 1½ to 2 feet below the surface.

This soil is slower to dry and warm up in spring than are the adjacent Penn and Lansdale soils. In most years, however, a seedbed can be prepared in time for all but the earliest vegetable crops grown in the area. Wet areas, where there are springs and seeps in depressions and on the lower slopes, persist well into the growing season. At times, they seriously interfere with tillage. The available moisture capacity is high. Roots rarely reach all of the moisture available, however, because of their restricted growth in the subsoil.

This soil is used for fruit, vegetables, nursery stock, commonly grown field crops, hay, and pasture. Also, a large acreage is in grass, trees, shrubs, and weeds on golf courses, in estates, and surrounding institutions and residential developments. This soil is suitable for growing corn, vegetables, spring small grains, hay, and pasture. It is fairly well suited to alfalfa grown in a short rotation. In some years yields of winter small grains are reduced as the result of frost heaving and the high water table.

Field or contour stripcropping is needed on most slopes to reduce runoff and erosion. A suitable cropping system is one no more intensive than 2 years of row crops

and a cover crop, 1 year of a small grain, and 2 years of grass-legume hay. If field strips are used, the period during which hay is grown should be extended to 3 years or more. Barnyard manure and crop residue incorporated into the soil help to maintain good tilth. Diversion terraces and grassed waterways help to further reduce losses from erosion and remove excess surface water. In some places they intercept the water from springs and from subsurface seepage. Random tile drains are effective in reducing wetness caused by seeps and springs.

This soil has moderate limitations for residential, light industrial, commercial, or institutional developments. It has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIe–5, woodland suitability group 6, community development group 9)

Readington silt loam, 8 to 15 percent slopes, moderately eroded (ReC2).—This soil has a thinner, more shaly surface layer and subsoil than the one for which a profile is described as typical for the series. It is on rolling uplands in the northern two-thirds of the county and occurs in small, widely scattered areas with the Penn, Lansdale, and Reaville soils.

In most places the substratum of shaly silt loam is 30 to 42 inches below the surface and bedrock is at a depth of 3 to 4 feet. A few areas are included, however, in which a very shaly substratum is within 18 inches of the surface. Also, bedrock is at a depth of only 30 inches in a few places. Throughout the central part of the county, this soil is browner than the one for which a profile is described as typical for the series. Near Norristown and Ambler, it is more sandy throughout than is typical. Included with this soil in mapping are areas of Abbottstown soils that have similar slopes.

Permeability is moderately rapid in the uppermost 12 inches of this soil and moderately slow below that depth. Surface runoff is medium to rapid, and the hazard of erosion is severe. During winter and early in spring, the water table is at a depth of 2 to 2½ feet on the upper part of the slopes and at a depth of only 1½ feet on the lower toe slopes.

This soil is slower to dry out and warm up in spring than are the adjacent Penn and Lansdale soils. In most years, however, a seedbed can be prepared in time to plant most of the crops grown in the area. Springs and seeps persist on the lower slopes well into the growing season. The available moisture capacity is high. Roots seldom reach all of the available moisture, however, because of their restricted growth in the subsoil.

This soil is used for fruit, commonly grown field crops, hay, and pasture. A small acreage is in lawns, trees, shrubs, or weeds within estates, on golf courses, and adjacent to developments. This soil is well suited to hay and pasture and is fair for corn, small grains, apples, and peaches. It is also suitable for alfalfa grown in a short rotation. Field or contour stripcropping is needed, and a suitable cropping system is one no more intensive than 1 year of a row crop, 1 year of a small grain, and 3 years or more of grass-legume hay.

Crop residue and manure should be incorporated into the soil, and diversion terraces and grassed waterways may be used to safely carry away runoff. On the toe slopes, random tile drains are effective in relieving wetness caused by seeps and springs. This soil has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IIIe–6, woodland suitability group 6, community development group 10)

Reaville Series

Moderately deep, moderately well drained or somewhat poorly drained, reddish shaly silt loams make up the Reaville series. These soils have a thin, slowly permeable subsoil and substratum that restrict the downward movement of water. They formed in material weathered from shale and siltstone on level to rolling uplands in the northern two-thirds of the county.

The Reaville soils occur with the well-drained Penn (fig. 28) and Klinesville soils. They are shallower and more shaly than the moderately well drained Readington soils and the somewhat poorly drained Abbottstown soils. They are shallower and less grayish than the poorly drained Croton soils.

In a typical profile of a Reaville soil, the surface layer is friable, reddish-brown shaly silt loam about 8 inches thick. From 15 to 25 percent of the surface layer is shale.

The uppermost 4 inches of the subsoil is friable, reddish-brown shaly silt loam with a few reddish-gray streaks and mottles. At a depth of 12 to 15 inches, this material grades to firm, weak-red shaly silt loam that is distinctly mottled with reddish gray. The subsoil is about 8 inches thick, and 15 to 35 percent of it is shale.

The substratum is very firm, weak-red or dusky-red very shaly silt loam. About 50 percent or more of the upper part is shale. The substratum grades to shale bedrock. Bedrock is generally at a depth of about 30 inches, but the depth ranges from 20 to 36 inches.

These soils are slowly permeable and have moderate to low available moisture capacity. They are very strongly acid to slightly acid and have low natural fertility.

These soils are suited to hay and pasture of shallow-rooted grasses and legumes that tolerate both wetness and drought. Bedrock near the surface and the high content of shale, high water table, and slow permeability are the major limitations to their use for developments.

Figure 28.—**Typical area of Reaville and Penn soils near Fagleysville. Reaville soils occupy the pasture where the cattle are grazing. Penn soils are on the uplands in the backgrouud.**

Reaville shaly silt loam, 0 to 3 percent slopes, moderately eroded (RsA2).—This soil is on flats and in depressions on undulating and rolling uplands in the northern two-thirds of the county. In most places its profile is the one described as typical for the series. In a few places, however, the subsoil is 10 to 15 inches thick and has prominent gray mottles 12 to 18 inches beneath the surface.

In wooded areas a litter of leaves and organic matter covers the surface and is underlain by a layer of very dark reddish-brown silt loam, 1 to 2 inches thick. Beneath the layer of very dark reddish-brown silt loam is a layer of friable, reddish-brown shaly silt loam 6 to 8 inches thick.

Included with this soil in mapping are areas in which the surface layer is dark reddish brown and is as much as 1 foot thick. Also included are areas where a thick, very firm, very shaly substratum is at a depth between 6 and 20 inches and bedrock is at a depth of 3 to 5 feet.

This soil is slowly permeable and has a high water table. The water table is at the surface or within a foot of the surface late in fall, in winter, and early in spring. Surface drainage is slow, and the hazard of erosion is slight. This soil is too wet early in spring to be worked with the adjacent well-drained soils. It dries very rapidly, however, and crop yields are reduced in most years by lack of available moisture. The areas near springs and seeps remain wet until early in summer, and the excess moisture hinders tillage. The available moisture capacity is moderate to low.

This soil is used for the commonly grown field crops and for hay and pasture. Also, part of the acreage is in grass, weeds, and brush and is in estates and in areas surrounding developments. This soil is well suited to hay and pasture consisting of grasses and legumes that are drought resistant and that tolerate wetness. It is fair to poor for corn, soybeans, and spring-sown small grains. Because of excessive winterkill, the soil is generally poorly suited to winter small grains and alfalfa.

If this soil is included in a regular cropping system, the crop needs to be planted in graded rows. A satisfactory cropping system consists of 1 year of a row crop, 1 year of a spring-sown small grain, and at least 3 years of grass-legume hay of adapted varieties. A cover crop ought to be seeded in the row crop to provide protection over winter, and crop residue should be incorporated into the soils. Open drains help to remove the surface water from low-lying flats and depressions. Wetness caused by springs and seeps can sometimes be reduced by installing tile drains if the depth to bedrock is adequate.

The high content of shale, bedrock near the surface, high water table, and slow permeability are severe hazards if this soil is used for residential, light industrial, commercial, or institutional developments. This soil also has severe limitations if used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–4, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 3 to 8 percent slopes, moderately eroded (RsB2).—This soil is more sloping than the soil for which a profile is described as typical for the series. Also, in many places it has a thinner subsoil that is distinctly mottled with gray in the lower 1 to 3 inches, just over the substratum. This soil is on undulating and rolling uplands scattered throughout the northern two-thirds of the county.

A layer of leaves and organic matter covers the surface in wooded areas. It is underlain by a layer of very dark reddish-brown silt loam, 1 to 2 inches thick. Beneath this layer is a layer of friable, reddish-brown shaly silt loam about 6 inches thick. In a few places, bedrock is as deep as 3 to 5 feet. The subsoil in a few areas is 10 to 15 inches thick, contains only a few pieces of shale, and is prominently mottled with gray throughout.

Included with this soil in mapping are areas in which the surface layer is less shaly than typical, has a dark reddish-brown color, and is as much as 1 foot thick. Also included are areas underlain by a thick, very firm, very shaly substratum at a depth of 6 to 20 inches.

Permeability is slow, and the water table is at the surface or within a foot of the surface in winter and early in spring. The soil is too wet early in spring to be worked with the adjacent well-drained soils. It dries rapidly, however, and by May it is often too dry for proper preparation of a seedbed. In most years crop yields are reduced by lack of moisture. Springs and seeps remain wet well into the growing season. The available moisture capacity is moderate to low. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, part of the acreage is in grass, trees, weeds, and brush within parks, golf courses, and estates, and in areas surrounding developments. This soil is well suited to hay and pasture consisting of grasses and legumes that resist drought and that also tolerate wetness. It is fairly well suited to birdsfoot trefoil, reed canarygrass, and tall fescue. This soil is fair to poor for corn and spring-sown small grains. Generally, because of excessive winterkill, it is poorly suited to alfalfa and winter small grains.

If this soil is included in a regular cropping system, field or contour stripcropping is needed and the cropping system ought to be no more intensive than 1 year of a row crop, 1 year of a spring-sown small grain, and at least 3 years of grass-legume hay. In winter the soil needs to be protected by a cover crop, and crop residue should be incorporated into it. In most places tile drains are not feasible, because bedrock is too near the surface.

Bedrock near the surface and the high content of shale, high water table, and slow permeability are severe hazards if this soil is used for residential, light industrial, commercial, or institutional developments. Also, problems can be expected if this soil is used as a disposal field for the effluent from septic tanks. (Capability unit IIIw–5, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 3 to 8 percent slopes, severely eroded (RsB3).—This soil is on undulating and rolling uplands in the northern two-thirds of the county. It has a thinner, more shaly surface layer and subsoil than the soil for which a profile is described as typical for the series.

In many places tillage is in the substratum, and in those areas the plow layer consists of dusky-red patches of very shaly silt loam. Shale bedrock is exposed in

217-083—67——10

some spots on narrow ridges and where the changes in slope are abrupt.

The thickness of the gray, mottled subsoil ranges from only 1 inch to about 10 inches. Bedrock is generally at a depth between 2 and 3 feet, but shallower areas are also included with this soil in mapping. Included are a few areas that are not severely eroded and a few areas of Readington and Abbottstown soils that have a thin, shaly surface layer.

Permeability is slow, and the water table is high. The water table is at the surface or within a foot of the surface during winter and early in spring. This soil is too wet early in spring to be plowed with the adjacent well-drained soils. It dries rapidly, however, and is droughty in a short time. Areas near springs and seeps remain wet well into the growing season. The available moisture capacity is low. Surface drainage is medium to rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, part of the acreage is in weeds, grass, and brush in areas of idle farmland, in estates, and in areas surrounding developments. This soil is fair for hay and pasture consisting of grasses and legumes that are drought resistant and that tolerate wetness. It is poor for corn and spring-sown small grains, and it is poorly suited to alfalfa or winter small grains. The crops need to be planted in graded strips, and a cropping system no more intensive than 1 year of a row crop followed by a cover crop, 1 year of a spring-sown small grain, and at least 4 years of hay consisting of adapted grasses and legumes is suitable. This soil is well suited to permanent hay or pasture made up of adapted grasses and legumes. It is well suited to birdsfoot trefoil and reed canarygrass. Manure and crop residue ought to be incorporated into the soil.

This soil has severe limitations for residential, light industrial, commercial, or institutional developments. Bedrock near the surface and the high content of shale, high water table, and slow permeability are hazards to be considered if a development is planned. Limitations are also severe if this soil is used as a disposal field for the effluent from septic tanks. (Capability unit IIIe–7, woodland suitability group 10, community development group 9)

Reaville shaly silt loam, 8 to 15 percent slopes, severely eroded (RsC3).—This soil is more sloping and has a thinner, more shaly surface layer and subsoil than the one for which a profile is described as typical for the series. It is on rolling uplands in the northern two-thirds of the county. This soil has many patches of dusky-red shale on the surface. In many places the surface layer is very shaly silt loam that contains a few white and gray streaks and mottles. In those areas tillage has been in the lower part of the subsoil and in the substratum. The subsoil ranges from 1 inch to 8 to 10 inches in thickness.

Included with this soil in mapping are areas in the south-central part of the county that are more sandy throughout than typical. Also included are areas of Croton and Abbottstown soils that are deeper and grayer than this soil but that have similar slopes. Other inclusions consist of small areas that are steeper than 15 percent.

This Reaville soil is slowly permeable and has a high water table. The water table is at the surface or within 1 foot of the surface during winter and early in spring. This soil is too wet in spring to be plowed with the adjacent well-drained soils, but it becomes droughty rapidly. During only a week or two is the content of moisture suitable for preparation of a seedbed and for planting. Springs and seeps, however, remain wet during the early part of the growing season. The available moisture capacity is low. Surface runoff is rapid, and the hazard of erosion is severe.

This soil is used for the commonly grown field crops, hay, and pasture. Also, a large acreage is in grass, weeds, and brush in areas of idle farmland, in estates, and in areas surrounding developments. This soil is suited to perennial hay and pasture, but it is poorly suited to corn and small grains. It is suited to reed canarygrass, birdsfoot trefoil, and other grasses that tolerate both wetness and drought. Hay and pasture ought to be reseeded, as needed, in alternate graded contour strips, and half the strips ought to be planted the first year and the rest the following year. The pastures should not be overgrazed.

This soil has severe limitations for use for light industrial, residential, commercial, or institutional developments. Also, it has severe limitations for use as a disposal field for the effluent from septic tanks. (Capability unit IVe–4, woodland suitability group 10, community development group 10)

Rowland Series

The Rowland series consists of deep, moderately well drained or somewhat poorly drained, nearly level silt loams on flood plains in the central and northern parts of the county. These soils formed in material washed from uplands underlain by red shale and sandstone.

The Rowland soils occur on stream bottoms with the poorly drained Bowmansville soils. Also, to a smaller extent, they occur on stream bottoms with the well-drained Bermudian soils.

In a typical profile of a Rowland soil, the surface layer is very friable, dark reddish-brown silt loam. It is about 10 inches thick.

The substratum consists of several layers of dark reddish-gray silt loam. The middle and lower layers are streaked with gray and red. Shale or sandstone bedrock is at a depth of about 4 feet, but the depth to bedrock ranges from 3 to 12 feet.

These soils are moderately permeable, but they have a high water table and are subject to flooding late in fall, in winter, and early in spring. Occasional overflows also occur during storms of high intensity in the growing season.

These soils are better suited to pasture or hay than to cultivated crops, but corn, soybeans, and spring-sown small grains do well. Wetness makes the soils poorly suited to winter small grains and alfalfa. The soils are severely limited for use for developments because of the flooding and seasonal high water table.

Rowland silt loam (Rt).—This soil has the profile described as typical for the series. It occurs in narrow bands along most of the streams in the northern two-thirds of the county.

In some places along the natural levees of the larger creeks, this soil is free of mottling to a depth of about

36 inches. In those areas its profile is similar to that of the Bermudian soil. This soil is more frequently flooded than the Bermudian soil, however, and the water table remains high for longer periods.

Included with this soil in mapping are small areas of Bowmansville silt loam that are too small to be mapped separately. These areas are generally shown on the map by a symbol for wet spots.

This Rowland soil is subject to flooding during winter and early in spring. Occasionally, it is flooded during the growing season. The water table is at or near the surface late in winter and early in spring. The soil is only slightly susceptible to erosion and has high available moisture capacity. Lime and fertilizer, applied to soils of the adjacent uplands, have been washed onto it. They have added to the fertility to some extent and have made this soil less acid.

This soil is used mainly for pasture. Cultivation is difficult because of the hazard of flooding and the size, shape, and location of the fields. Where this soil is not susceptible to flooding and can be reached easily, it is well suited to corn, soybeans, spring-sown small grains, and hay. It is not well suited to alfalfa and winter small grains, because those crops are likely to be damaged by the high water table during winter and early in spring. Surface drainage can be improved by open drains, and excessive water in the soil can be reduced by installing tile drains.

Because of the seasonal high water table and hazard of flooding, this soil has severe limitations for residential, light industrial, commercial, or institutional developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, coal overwash (Ru).—This soil has a surface layer of black silt loam that is 1 to 3 feet thick. The substratum is slightly less reddish than the one in the profile described as typical for the series, and bedrock is at a depth of 4 to 12 feet. This soil is on the flood plains of the Schuylkill River. The thickness and dark color of the surface layer were caused by the deposition of coal sediment washed from the anthracite region far to the north of this county.

This soil is occasionally flooded in fall or early in spring. Permeability is moderate, and surface drainage is slow. The hazard of erosion is slight. The water table is within 1 to 3 feet of the surface during winter and early in spring.

This soil is well suited to pasture, but most of the areas are overgrown with weeds and brush or young trees. The soil is generally not cultivated, because it occurs between the river and industrial developments, railroads, and roads. Many large basins for impounding sediment dredged from the river have been constructed in the areas. The areas that are covered by thin layers of coal sediment are fairly well suited to corn, soybeans, spring-sown small grains, hay and pasture. This soil is poorly suited to winter small grains and alfalfa. It ought to have a cover crop and crop residue plowed under to help to increase the content of organic matter. Tile drainage and open drains help to remove the excess surface water and the excess water in this soil.

This soil has severe limitations as a site for developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, local alluvium, 0 to 3 percent slopes (RwA).—This soil is redder and has less gray mottling than the one for which a profile is described as typical for the series. Also, it generally contains more shale. It is in depressions and drainageways at the heads of streams and is above the normal level of the flood plains. This soil consists of material that has eroded from the Penn, Lansdale, Readington, and similar soils of the nearby uplands. The deposited material is generally deep, but it ranges from 18 inches to 4 or 5 feet in thickness.

This soil has a high water table that is near the surface during winter, early in spring, and following extended periods of heavy rainfall during the growing season. Permeability is moderate, and surface drainage is slow. The available moisture capacity is high. Some local flooding occurs during periods of intense rainfall.

This soil is usually farmed with the adjacent soils. If it is used for cultivated crops, the most intensive cropping system suggested consists of 2 years of row crops with a cover crop to protect the soil in fall and winter, 1 year of a spring-seeded small grain, and 1 year of grass-legume hay. In some places tile drains and open drains would help to remove excess surface water and excess water in the soils.

Because of the seasonal high water table, slow surface drainage, and hazard of overflow during flash storms, this soil has moderate limitations for developments. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Rowland silt loam, local alluvium, 3 to 8 percent slopes (RwB).—This soil is more reddish and has less gray mottling than the one for which a profile is described as typical for the series. Also, it generally contains more shale or fragments of sandstone. This soil consists of soil material that has eroded from the Penn, Lansdale, Readington, and similar soils of the uplands. This soil material was deposited in swales and drainageways at the heads of streams above the normal level of the flood plains. At a depth between 18 inches and about 4 feet, this soil is underlain by material weathered from bedrock. In places bedrock is at a depth of only 2 feet, but in other places it is as deep as 6 feet.

Ordinarily, this soil is not subject to flooding, but it is flooded for brief periods during heavy rainstorms. The water table is high during winter, early in spring, and following periods of extended heavy rainfall. Springs and seeps at the base of upland slopes make some of the areas wet in spring and early in summer. The available moisture capacity is high.

Part of the acreage is idle or is in wooded areas, but most of it is farmed with the soils in adjacent fields. This soil is better suited to sod than to cultivated crops. It should be kept as a waterway for carrying away excess surface water from the adjacent uplands. If cultivated crops are grown in the larger areas, the most intensive cropping system suggested consists of 2 years of row crops and a cover crop to protect the soil in fall and winter, 1 year of a spring-seeded small grain, and 2 years or more of grass-legume hay. Growing the crops in graded strips and installing tile drains and open drains will help to reduce gullying and remove excess surface water and excess water in the soil.

This soil has moderate limitations for use in developments. It is suitable for use in open spaces to be kept in grass, trees, or shrubs. (Capability unit IIw–1, woodland suitability group 5, community development group 12)

Stony Land, Steep

Stony land, steep (StE) occurs in areas of Manor, Penn, Neshaminy, and Edgemont soils. The slopes range from 25 to 80 percent. The areas are so stony or ledgy that use and management is similar for all of them, and it is not practical to map individual soil types or phases. Also, the soils are generally shallower than typical for their series, and they have a thin surface layer. The surface layer consists of 1 to 2 inches of leaf litter over a dark-colored A1 horizon of mixed organic material and mineral soil. Below the A1 horizon is the normal sequence of horizons. Depth to bedrock ranges from several inches to 10 feet.

Surface runoff is rapid, and internal drainage is medium to rapid. The available moisture capacity and natural fertility range from high to low.

This land type is suitable only for recreational or esthetic purposes, for watershed protection, or for use as a wildlife propagation or refuge area. Trees and shrubs planted in suitable locations help to maintain and augment the cover of native vegetation and thus improve the protective cover and esthetic value of the land. (Capability unit VIIIs–1, woodland suitability group 5, community development group 13)

Watchung Series

The Watchung series consists of deep, poorly drained soils that formed in material weathered from dark-gray or black igneous rocks. These soils are nearly level and gently sloping, and they have a slowly permeable, sticky and plastic subsoil that impedes the downward movement of water.

Most areas of these soils are on low-lying flats and benches in the northern half of the county. They are adjacent to the well drained Neshaminy and moderately well drained or somewhat poorly drained Mount Lucas soils. The Watchung soils are more clayey than the poorly drained Croton and Bowmansville soils that are on nearby flats, in depressions, and on flood plains.

In a typical profile of a Watchung soil, the surface layer is friable, dark grayish-brown silt loam about 8 inches thick. This layer has a few light-gray mottles.

The subsoil is firm, grayish-brown to gray silty clay loam that is about 30 inches thick. It has many prominent mottles of strong brown and dark gray, and it is sticky and plastic when wet.

The substratum, beginning at a depth of about 42 inches, is friable, yellowish-brown loam mottled with gray and reddish brown. About 10 percent of it consists of fragments of rock. The substratum is about 18 inches thick. Bedrock is generally at a depth of about 5 feet, but the depth to bedrock ranges from 4 to 5 feet.

These soils are slowly permeable and have high available moisture capacity. They are medium acid to neutral and have moderate to high natural fertility.

The Watchung soils are fairly well suited to permanent pasture, wooded areas, and wildlife habitats. They have severe limitations for use in developments, but they can be used for open space conservation areas.

Watchung silt loam, 0 to 3 percent slopes (WaA).—This soil is on low-lying flats and depressions and on a few broad upland summits in the northern half of the county. It has the profile described as typical for the series. In wooded areas, however, a layer of partly rotted leaves covers the surface. The leaves are underlain by a layer of black silt loam, 2 to 4 inches thick, that, in turn, is underlain by a layer similar to but lighter colored than the surface layer described in the profile given for the series.

Where this soil occurs in depressions, the surface layer is 12 to 18 inches thick. In some areas this soil is more silty or more sandy than the soil for which a profile is described as typical. In a few areas the surface layer is only 4 to 6 inches thick, and 5 to 20 percent of it consists of pieces of rock.

This soil is slowly permeable and has a water table at the surface late in fall, in winter, and early in spring. Surface runoff is very slow, and water is ponded in the depressions and on low-lying flats. This soil is slow to dry out in spring. During the growing season, it remains wet for a week or two following periods of heavy rainfall. The hazard of erosion is slight, except on long slopes that are cultivated. The available moisture capacity is high.

A large part of the acreage is used for pasture, though much of it is idle and is overgrown with weeds, brush, and young trees. A small acreage is in field crops and hay. This soil is suited to pasture, trees, and wildlife habitats. If it is used for pasture, birdsfoot trefoil, reed canarygrass, and other legumes and grasses that tolerate wetness are suitable. Open drains help to remove the excess surface water, but they require constant maintenance if they are to remain effective. The pastures should not be grazed in spring and late in fall while the soil is saturated. Plantings of white pine are likely to be most successful for the wooded areas.

This soil is suitable for open space conservation areas that are kept in native trees, shrubs, and grasses. It has severe limitations for use in developments. (Capability unit Vw–1, woodland suitability group 9, community development group 11)

Watchung silt loam, 3 to 8 percent slopes (WaB).—In most places the surface layer of this soil is 6 to 8 inches thick and is browner and contains fewer mottles than the surface layer in the profile described as typical for the series. This soil is on benches and on the lower slopes in the uplands in the northern half of the county.

In places this soil has a layer of leaves and partly rotted organic matter on the surface. Beneath the leaves is a layer about 2 inches thick of black silt loam that, in turn, is underlain by a layer that is similar to but lighter colored than the surface layer of the profile described as typical for the series. In a few areas, plowing has mixed the upper part of the subsoil with the material in the plow layer. Where this soil is in depressions and on some of the lower toe slopes, its surface layer is 10 to 15 inches thick.

This soil is slowly permeable and has a water table at the surface or near the surface late in fall, in winter,

and early in spring. Surface runoff is slow to medium, and the hazard of erosion is slight. This soil is slow to dry out in spring and during the growing season. Also, it remains wet for several days to a week following periods of heavy rainfall. The available moisture capacity is high.

This soil is used for the commonly grown field crops, hay, and pasture. Also, a large acreage is idle and is overgrown with grass, weeds, brush, and young trees. This soil is suited to pasture, trees, and wildlife habitats. If it is used for pasture, however, grasses and legumes that tolerate wetness are needed, and birdsfoot-trefoil and reed canarygrass are well suited. Grazing should be delayed in spring until the water table has lowered. Open drains will help to remove the excess surface water.

Where this soil is in trees, plantings of white pine are likely to be the most successful. Small areas are especially suitable for planting trees, grass, and shrubs that will provide food and cover for wildlife. This soil has severe limitations for use in developments. (Capability unit VIw–2, woodland suitability group 9, community development group 11)

Watchung very stony silt loam (Wc).—On the surface this soil has a layer of leaves and partly rotted organic matter, 1 to 3 inches thick, over a layer, 2 to 5 inches thick, of very dark grayish-brown to black very stony silt loam. Below this is a layer, 3 to 5 inches thick, of dark grayish-brown very stony silt loam mottled with brownish gray and gray. The subsoil and substratum are like those described as typical for the series, except that 1 to 5 percent of the soil material in each of these layers consists of large stones. Stones that are 1 to 12 feet in diameter occupy 1 to 10 percent of the surface of this soil. This soil is nearly level or gently sloping and is on flats or benches and in depressions in the northern half of the county.

Included with this soil in mapping are a few areas that have slopes of more than 8 percent. In some places the surface layer is like that in the profile described as typical, but 1 to 3 percent of the surface is covered with stones.

This soil is slowly permeable and has a high water table. The water table is at the surface or only about 1 foot below the surface late in fall, in winter, and early in spring. Surface drainage is slow to very slow, and water is ponded on low-lying flats and in depressions. The hazard of erosion is slight, and this soil has high available moisture capacity.

This soil is mainly in wooded areas consisting of mixed oaks, hickory, ash, red maple, and dogwood. A few areas are in pasture. The more sloping, less stony areas are suitable for limited use for grazing of native grasses. Mowing of the pastures and renovation are not practical, because of the many stones.

Plantings of white pine are fairly well suited to these soils. The wooded areas ought to remain in trees, but improvement cutting should be done to remove the poorly formed trees and undesirable species. This soil is well suited to native grasses, shrubs, and trees that provide food and cover for wildlife. It has severe limitations for use in developments. (Capability unit VIIs–3, woodland suitability group 9, community development group 11)